# APPLICATION FOR CERTIFICATE OF PUBLIC CONVENIENCE AND NECESSITY

# FORWARD WIND ENERGY CENTER

## SEPTEMBER 2004

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URS Project No. 25365114.00004
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## TABLES



## FIGURES

## APPENDICES

## ACRONYMS

| | |
|---|---|
| AHI | Architecture History Inventory |
| ASI | Archaeological Site Inventory |
| AST | Aboveground Storage Tank |
| ATC | American Transmission Company |
| BIA | Bureau of Indian Affairs |
| BLIS | Brownfield Location Information System |
| BMP | Best Management Practices |
| CFR | Code of Federal Regulations |
| CO | Carbon Monoxide |
| CPCN | Certificate of Public Convenience and Necessity |
| DATCP | Department of Agriculture, Trade and Consumer Protection |
| db | Decibel |
| FAA | Federal Aviation Administration |
| FEMA | Federal Emergency Management Association |
| FIRM | Flood Insurance Rate Map |
| GE | General Electric |
| kV | Kilovolt |
| LCD | Land Conservation Department |
| msl | Mean sea level |
| MVA | Megavolt Ampere |
| MW | Megawatt |
| $NO_X$ | Nitrogen Oxides |
| NRCS | Natural Resource Conservation Service |
| O&M | Operations and Maintenance |
| PSC | Public Service Commission |
| RPS | Renewable Portfolio Standard |
| SCADA | Supervisory Control and Data Acquisition |
| SCS | Soil Conservation Service |
| SHSW | State Historical Society of Wisconsin |
| $SO_2$ | Sulfur Dioxide |
| SPCC | Spill Pollution Containment Control |
| SWPPP | Stormwater Pollution Prevention Plan |
| USDA | United States Department of Agriculture |
| USEPA | United States Environmental Protection Agency |
| USFWS | United States Fish and Wildlife Service |
| USGS | United States Geological Survey |
| UST | Underground Storage Tank |
| V | Volt |
| WDNR | Wisconsin Department of Natural Resources |
| WisAHRD | Wisconsin Archaeological and Historic Resources Database |
| WisDOT | Wisconsin Department of Transportation |

| | |
|---|---|
| WMU | Water Management Unit |
| WQMP | Water Quality Management Plan |
| WTG | Wind Turbine Generators |
| WWI | Wisconsin wetland inventory |

## DEFINITIONS

**Brownfield Site** – A property, where expansion, redevelopment, or reuse may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant.

**Collection System** – A system of underground cables that transfers the power generated by each wind turbine to a central location.

**Forward Energy LLC** – A subsidiary of Invenergy Wind LLC. Invenergy Wind originates and develops its own wind projects from conception to completion and long-term operation. Forward Energy LLC will construct, own and operate the Forward Energy Center.

**Nacelle** – A component of a wind turbine that sits atop the turbine tower and houses the gearbox, low and high-speed shafts, generator, yaw system, pitch system, controller and brake.

**Project Area** – An approximate 32,400 acres of land identified by Forward Energy as the area in which detailed analysis (such as environmental, engineering and design, etc.) and community and landowner involvement has been conducted in order to identify locations for proposed wind turbine generators and associated equipment. The Project Area was identified as part of a three-tiered siting process.

**Useful Conversions:**

To convert from Meters to Feet, simply multiply the Meters by 3.2808.

To convert from Feet to Meters, simply multiply the Feet by 0.3048.

# 1.00 PROJECT DESCRIPTION AND OVERVIEW

Forward Energy LLC submits this document to the Public Service Commission of Wisconsin (PSC) as part of its application for a Certificate of Public Convenience and Necessity (CPCN) pursuant to Wisconsin Statutes §196.491(3) and Chapter PSC 111, Wisconsin Administrative Code. This document follows the order of the PSC's guide document titled *Public Service Commission of Wisconsin Information Requirements for Electric Generation Construction Projects Over 100 MW*, dated November 19, 2001.

## 1.01 OWNERSHIP AND OPERATING ENTITY

The proposed Forward Wind Energy Center (Energy Center) will be located in Fond Du Lac and Dodge Counties, Wisconsin and will have an operating capacity of up to 200 megawatts (MW). Forward Energy LLC (Forward Energy), a subsidiary of Invenergy Wind LLC[1] will construct, own and operate the Energy Center. The Energy Center is a wholesale merchant plant under Wisconsin law.

The total electrical output of the Energy Center will be sold directly to Wisconsin utilities under several Power Purchase Agreements. Wisconsin Statutes §196.378(2) established the Wisconsin Renewable Portfolio Standard (RPS), which requires retail electric providers to supply a minimum portion of their total retail electric sales either directly from renewable resources or through renewable resource credits from another retail electric provider. According to this statute, utilities must generate 2.2% of their electricity from renewable energy sources by 2011. The Energy Center will qualify as a Renewable Resource in accordance with Wisconsin Administrative Code Section PSC 118.05.

## 1.02 TYPE OF POWER PLANT PROPOSED

The proposed Energy Center Project Area is situated within approximately 32,400 acres of predominately agricultural land located near Brownsville, Wisconsin, within the Towns of

[1] Invenergy Wind LLC (Invenergy Wind), is executing one of the largest wind energy development programs in the industry. Invenergy Wind's focus is on the development and long-term ownership and operation of utility scale wind projects ranging in size from 25 to 300 MW. Currently, Invenergy Wind has in excess of 25 projects totaling more than 2,500 MW of new wind energy generation in active development in the United States and Canada. Invenergy Wind originates and develops its own wind projects from conception through completion and long-term operation. With this long-term perspective, Invenergy Wind takes a proactive approach to building strong relationships with various project stakeholders including landowners, host communities and power purchase customers. Invenergy is headquartered in Chicago, IL, and has professional staff located near Denver, Milwaukee, Toronto and Washington D.C.

Oakfield, Byron, Leroy and Lomira in southern Fond Du Lac and northern Dodge Counties. Between 70 and 135 wind turbines would be sited within the Project Area depicted on the attached Figure 1 (A-B). Figure 2 (A-D) provides an aerial photograph of the Project Area. Only a small portion of the Project Area shown will actually be developed as part of the Energy Center.

The major components of the Energy Center and its ancillary facilities include the following:

- Wind Turbines
- Wind Turbine Foundation
- Pad Mounted Transformer
- Electric Collection System
- Interconnection Substation
- Step-up Transformer
- Communication Lines
- Supervisory Control and Data Acquisition (SCADA) System
- Operations and Maintenance (O&M) Building
- Access Roads

The Energy Center will utilize approximately 70 to 135 wind turbines in the 1.0 MW to 2.0 MW class that will generate a rated capacity of up to 200 MW of electrical power. The project is scalable and can be built in several phases to accommodate varying capacity requirements.

Forward Energy will likely choose turbines from one of the two leading turbine manufacturers for development of the project: Vestas V82 wind turbine, or the General Electric (GE) Wind Energy 1.5 sl/s wind turbine. Wind Turbine Generators (WTG) are standard products with few options and consistent operating parameters. Other turbine models will be evaluated for the project and if a model other than the two stated above is selected it will meet the parameters outlined within this application. Other wind turbines may have higher outputs up to as much as 3.0 MW, but would be consistent with the typical turbine sizing described below.

The Energy Center will consist of three blade upwind turbines on tubular towers that will be a maximum of 100 meters (328 feet). The three blades on each turbine will each be from 35 to a maximum of 46 meters (115 to 151 feet) in length. The resulting maximum turbine height is approximately 146 meters (480 feet) from ground to blade tip based upon the tallest tower and longest blade combination. The wind turbine will most likely consist of an 82-meter tower (269 feet) resulting in a height of 122 total meters (400 feet) when combined with a 40-meter blade. Figure 3 provides a line diagram of a typical wind turbine.

The 3 blades are hub mounted to the nacelle, which sits atop the tower. The nacelle is a compartment that includes the gearbox, low and high-speed shafts, generator, yaw system, pitch system, controller and brake. The nacelle acts as a cover and protects the components inside. The yaw system components inside the nacelle rotate to turn the blades into the direction of the wind. The pitch system located within the hub adjusts the blades pitch to maximize efficiency. Figure 4 provides a schematic of a typical wind turbine. Figure 5 provides a schematic of a typical wind turbine base. A maintenance door is located at the base of each wind turbine tower to provide access to the components inside the nacelle. This door will be locked to prevent entry by unauthorized personnel.

The turbine foundation will be designed based on-site specific soil and geotechnical conditions. Based on the conditions at each site the foundation will either be a deep foundation or spread footer. A typical deep foundation will be placed on an area approximately 7.6 by 7.6 meters (25 by 25 feet) in size. A typical spread footer will have a similar footprint at grade, but may spread out below grade to as much as 15 by 15 meters (49 by 49 feet) in size. Figure 6 and 7 provide a schematic of a typical deep foundation and spread footer foundation respectively.

A wind turbine develops a wind tail, which has a slower wind velocity than the wind before the tower. This wind tail is also known as a "wake." This wake can impact the capacity of a wind tower to capture the best available wind velocity in an area and produce the optimum amount of electricity. The wind turbines are therefore spaced far enough apart to minimize the wake that is experienced by the down wind turbines in the Energy Center in the predominant wind directions. Thus, the wind turbines associated with the Energy Center will typically be sited approximately 1,200 to 2,000 feet apart.

There are currently no planned additions or expansions beyond the capacity described herein at the Energy Center in the future.

It is not expected that a tower would ever fall over, but if such a catastrophic event were to occur the siting of the turbine should minimize any impacts. The turbines will be sited a minimum of 1,000 feet from any occupied structure unless agreed to by the property owner. The wind turbines will also be sited 1.1 times their height from any public roads or aboveground electric utility lines.

Both the Federal Aviation Administration (FAA) and Wisconsin Department of Transportation (WisDOT) will be consulted to determine the appropriate lighting for the Energy Center. Considerations will be made to reducing the potential impact to migratory birds and bats and to

develop a pattern that will produce adequate lighting for aviation safety while minimizing aesthetic impacts. It is anticipated that not all turbines will be fitted with aviation lighting. Prior to commencing construction the FAA and WisDOT will be notified of the final turbine height, ground elevation and coordinates of each WTG and a determination of no hazard to aviation will be requested. Forward Energy will propose a lighting plan to locate aviation lighting on typically every third turbine for those turbines on the outer perimeter of the Energy Center. Select turbines within the Energy Center will be proposed for lighting based upon spacing and elevation. Based upon the avian study, Forward Energy will recommend the use of L864 flashing red lights with the shortest possible flash time and longest possible duration between flashes. The FAA and WisDOT will ultimately determine the needed lighting to maintain aviation safety and which turbines and what type of lighting is required.

## 1.03 AUXILIARY FACILITIES

Auxiliary facilities that will support the operation of the Energy Center include the O&M building, communication lines, SCADA system, and the electrical system.

The Energy Center will require a building or storage space to house spare parts and tools to be utilized for the operation and maintenance of the WTGs. The O&M building will be approximately 200 x 60 feet in size. A parking area will be adjacent to the O&M building with a capacity for 10 vehicles. The SCADA system will be located inside the O&M building and will provide local and remote access to the turbine controls for operational control and for data collection. The location of the O&M building has not been determined at this time; however, Forward Energy will likely utilize an existing building in the Project Area or local region. In the event a suitable building cannot be found, Forward Energy would construct a new building structure.

The Energy Center electrical system will be comprised of the following components: transformer, underground cable, overhead transmission line, one interconnection substation, 138 kV high voltage connection, and generator step-up transformers. A discussion of the electrical system is included below in Section 1.04.

## 1.04 ELECTRIC TRANSMISSION AND NATURAL GAS INTERCONNECTIONS

The generator in each nacelle delivers an output at 690 volts (V) that is converted to 34.5 kilovolts (kV) at a pad-mounted transformer that sits adjacent to the base of each tower or at a transformer located inside the nacelle. The 34.5 kV side of the transformer is connected to

underground cable referred to as the "collection system." The underground collection system connects the output of the wind turbines in circuits of approximately 20 to 25 Megavolt Ampere (MVA) that all run back to the interconnection substation through underground transmission lines. Some of the runs back to the interconnection substation may include segments of overhead 34.5 kV circuits to minimize land impacts. The various collector circuits are then aggregated and the voltage is stepped up to the system voltage of 138 kV and interconnected to the existing transmission system. The underground collection system is routed to minimize impact and where possible will typically run adjacent to access roads.

The electric transmission line will interconnect the Energy Center to the existing South Fond Du Lac-Butternut 138 kV line. Figure 8 (A-B) and 9 (A-D) identifies the location of the electric collection system, substation, and transmission line required for the Energy Center. A discussion of the Interconnection Evaluation Study Report conducted for the project is included in Section 3.01.

The energy from the wind turbines is generated by harnessing the energy of the wind and converting it to mechanical and then electrical energy. Therefore, natural gas will not be required for the project.

## 1.05 POTENTIAL SECONDARY DEVELOPMENT

At this time there are no specific short or long term planned additions or expansions at the Energy Center. However, this project was developed to address the need for renewable power in Wisconsin and has received significant interest from many of the Wisconsin utilities. There is a possibility that if this interest by the Wisconsin utilities for renewable energy from this site continues there might be an opportunity for expansion in the future to meet that interest and the need for renewable energy by the Wisconsin utilities.

## 1.06 SITING PROCESS AND SELECTION OF SITES

In 2002, Forward Energy first considered development of a wind energy project in Wisconsin to provide Wisconsin utilities an opportunity to participate in a renewable resource project and meet the enacted 1999 Wisconsin Act 9 Renewable Portfolio Standard and other proposed legislation calling for Wisconsin utilities to increase their electric generating portfolios to include renewable power.

Development of the proposed project required several years of study that included a three tiered siting process to identify the most favorable Project Area. The first evaluation was conducted at the state level, where Forward Energy determined which regions across the state had the wind resource necessary to develop this type of project. Once a region of the state was identified, a second tier of evaluation was performed that included review of engineering feasibility, environmental compatibility, community support and acceptance and other criteria. The conclusion of this second tier evaluation resulted in identifying the Forward Energy Center Project Area as described in this report. The third tier of evaluation including a detailed analysis of the Project Area is provided in this application. The discussion below provides more detail of the siting study performed by Forward Energy.

Tier One Evaluation – State Level

Forward Energy reviewed data from meteorological towers that existed throughout the state to determine which regions of the state would have the wind resource necessary to make a project of this type possible. Data obtained from these towers generally includes wind speed and direction, temperature, dewpoint, and other valuable meteorological information. Based on data collected, the Eden, Wisconsin region was identified as a strong wind resource area with excellent exposure to prevailing winds from the west and southwest. As the result of these findings, Forward Energy moved ahead to evaluate the region (an approximate 30-mile radius area) for further evaluation.

Tier Two Evaluation – Regional Level

The purpose of a second tier evaluation was to determine if specific criteria could be met within the region that would result in the identification of a viable Project Area. The key criteria were sufficient land available for this size project, engineering and design, environmental compatibility, and community support and acceptance. Specifically, Forward Energy evaluated the following:

- Availability of land and compatibility with existing land uses;
- Topographic elevations;
- Wind turbine engineering and design parameters (including feasible turbine layouts);
- Location of existing substations and transmission lines suitable for interconnection;
- Community and landowner support and acceptance of the project; and
- Preliminary review of environmentally sensitive areas, such as parks, wetlands, waterbodies, habitats, etc.

During the second tier evaluation, Brownfield sites were also reviewed to determine if sites of adequate size were available for the development of the Energy Center. According to the Wisconsin Brownfield Location Information System (BLIS), there are 60 Brownfield sites within the state of Wisconsin. Of these 60 sites, 52 are located in Milwaukee, a location too congested to host a wind energy center of this size. The remaining 8 sites are located in Whitewater, Mukwonago, Germantown, Stevens Point, Green Bay, Flambeau, Medford, and Viroqua.

Only three of the locations listed above are located in the southeast portion of the state (Whitewater, Mukwonago, and Germantown) where viable wind resources are available. One criteria for the selection of the Project Area is the availability of significant tracts of cleared land. Due to this requirement, the Brownfield locations were not considered a feasible option.

The results of the evaluation identified an area of land that met the criteria needed for further development of the project. The following conclusions were made about the area identified during the tier two evaluation:

- Significant tracts of cleared land are available within the region.
- A specific area of the region is above an elevation of 1,000 feet providing added wind resource availability.
- The terrain and geography of the area was suitable for the engineering and design of a wind farm.
- The Project Area is located near an existing electric transmission line suitable for interconnection.
- Forward Energy conducted a community and landowner outreach program to determine the level of community support and acceptance of the project in the proposed area. The results of this program have shown strong community support and acceptance for the project.
- Forward Energy performed preliminary environmental reviews to determine sensitive environmental resources in the Project Area so as to avoid or minimize any adverse environmental impacts. The results of this preliminary review show that adverse impacts to the environment are avoidable or unlikely.
- A sophisticated mapping program utilizing land use, meteorological data, wind turbine engineering and design parameters, and other project siting criteria was engaged to identify ideal locations for the wind turbines. Based on the results of this effort, preferred wind turbine sites were identified within the Project Area.

Tier Three Evaluation – Project Area Level

Once the Project Area was identified from the second tier study, Forward Energy continued to collect data, refine placement of the wind turbines based on engineering and design parameters, and conduct community and landowner meetings to inform the public.

Specific areas of analysis for the tier three evaluation included the following:

- Land Use and Zoning
- Site Topography
- Geology
- Soils
- Existing Vegetative Communities
- Threatened and Endangered Species
- Archaeological and Historical Resources
- Surface Water Resources
- Wetlands
- Floodplains
- Projected Noise Measurements
- Aviation
- Environmental Mitigation
- Community Resources
- Recreation and Publicly Owned Lands
- Demographics
- Community Services
- Local Government Infrastructure
- Benefits to the Community
- Transportation Infrastructure
- Public Outreach

Figure 10 (A-B) identifies the areas excluded from potential development of the Energy Center based on the results of the tier three evaluation. This application presents the results of this study. For portions of the study based on the turbine characteristics, a worst case scenario was used to present a more rigorous assessment.

The final phase of the third tier will involve coordinating all of the turbine sites and the multitude of landowners where they are located with the results of the studies in this report to make the final turbine site selections.

## 1.07 PLANT LIFE SPAN

The wind turbines are designed to have a life span in excess of 20 years. Near the end of the projected life span of the wind turbines, efforts may be made to replace the turbines to continue to utilize the valuable wind resource in this area.

## 1.08 SCALE DRAWING OF PLANT

Figure 8 (A-B) and 9 (A-D) identify the location of the proposed wind turbine sites within the project area along with their auxiliary facilities. A scale drawing of a typical wind turbine layout is included as Figure 11. This figure provides a representative example of the anticipated layout at each wind turbine site including the turbine base, pad mounted transformer, collection system, communication lines, and associated access road. Figure 12 provides a scale drawing of the interconnection substation. Figure 13 presents a photo simulation of the Energy Center from the northeast corner of Project Area looking west from Route 41.

## 1.09 PURPOSE AND NEED

The 1999 Wisconsin Act 9 (effective January 1, 2001) created a Renewable Portfolio Standard (RPS), requiring Wisconsin electric utility providers to meet certain minimum percentages of their total retail sales with renewable resources. The minimum percent gradually increases to 2.2 percent of the total retail electric sales by 2011. Further, as indicated in the Wisconsin Public Service Commissions' Strategic Energy Assessment Draft Report dated April 15, 2004 the Governor's Task Force on Energy Efficiency and Renewables suggests that the RPS be increased to 10 percent by 2013. Further discussion by the task force in June 2004 considered a requirement for state facilities to purchase 10 percent of their energy from renewable resources by 2006 and 20 percent by 2010. As such, Wisconsin utilities have shown interest in increasing their renewable portfolios.

In 2002, Forward Energy first considered development of a wind energy project in Wisconsin to provide Wisconsin utilities an opportunity to participate in a renewable resource project and meet the enacted 1999 Wisconsin Act 9 RPS and other proposed legislation calling for Wisconsin utilities to increase their electric generating portfolios to include renewable power.

Forward Energy plans to supply the necessary power to regulated utilities through power purchase agreements.

The Energy Center is a wholesale merchant plant under Wisconsin law; therefore, a discussion of purpose and need for the Energy Center is not required.

## 1.10 SUPPLY ALTERNATIVES

Forward Energy will construct, own and operate the Energy Center and will supply power to regulated utilities to meet renewable resource requirements. The Energy Center is a wholesale merchant plant; therefore, a discussion of supply alternatives for the project is not required.

## 1.11 COSTS

The Energy Center is a wholesale merchant plant; therefore, a discussion of economic factors, including capital costs of the completed facility and all related facilities is not required. Forward Energy is responsible for and takes the risk of the cost to complete the facility unlike a typical Investor Owned Utility where the cost of a facility would be added to the rate base upon completion.

## 1.12 WORKFORCE SIZE AND SKILLS

Construction of the Energy Center will require approximately 150 construction workers on average and 200 to 250 construction workers at the peak construction period. Following are the skilled workers that will be required for the construction of the Energy Center:

- Electricians
- Laborers
- Operating Engineers
- Carpenters
- Cement Finishers
- Iron Workers
- Construction Management
- Operating Staff

Approximately 6 to 10 full-time staff will be required during the operation of the Energy Center. The employees required for the operation of the Energy Center include technicians with electrical, mechanical and instrument capabilities. It is expected that the workforce during

construction and operation would be from both local and regional sources, depending upon the availability of qualified persons. Efforts will be made to hire individuals from the local community.

## 1.13 HOURS OF OPERATION

The proposed Energy Center will be available for operation 24 hours a day, seven days a week unless a turbine is temporarily shut down for maintenance activities. Actual operation of the turbines will be dictated by the wind. Section 1.16 discusses the wind speed parameters required for operation of the turbines.

## 1.14 FUEL TYPE AND SOURCES

The Energy Center utilizes only wind for operation of the turbines. There are no primary or backup fuels associated with the operation of the Energy Center.

## 1.15 ADDITIONAL ITEMS FOR COAL PLANTS

Forward Energy's proposed Energy Center does not require coal for operation. This request is therefore not applicable to the project.

## 1.16 OPERATING CHARACTERISTICS

Operation of each wind turbine is dictated by the wind. The turbines will "cut-in" (begin to turn or be allowed to operate) at a wind speed of between 3 and 4 meters per second (7 to 9 miles per hour). The turbines will "cut-out" (shut down to protect the equipment) at a wind speed of between 20 and 25 meters per second (45 to 56 miles per hour). The turbines will either utilize a stall or pitch system to cut out of operation when the cut-out wind speed is encountered. The specific cut-in and cut-out thresholds will be dependant upon the selected turbine model.

The net annual capacity factor for the project is expected to be between 30 and 40 percent and will depend upon the selected equipment and final site layout. The capacity factor is simply the anticipated energy generated by the wind turbine, divided by the maximum energy generation possible at full capacity if the wind turbines operated 8,760 hours on an annual basis.

## 1.17 REQUIRED PERMITS

A list of the potential environmental permits and regulatory approvals required for the siting, construction, and operation of the Energy Center are provided in Appendix A. This document

identifies each permit and approval expected to be required at the federal, state and local level and identifies the contact name, phone number and schedule of each permit or approval.

The Towns of Leroy and Lomira are located within Dodge County, which has an ordinance governing the location of wind turbines within the county. The Towns of Byron and Oakfield are located within Fond Du Lac County, which does not have an ordinance governing the location of wind turbines, and as such the permitting will be primarily at the town level. Forward Energy has discussed the project with each of the Towns and Counties and will continue to coordinate with them through the duration of the project.

## 1.18 AGENCY CORRESPONDENCE

Copies of correspondence with federal, state, and local agencies involved in the permitting process of the Energy Center are included in Appendix B. Forward Energy will provide copies of additional correspondence to the PSC and Wisconsin Department of Natural Resources (WDNR) if it is received.

## 1.19 PERMITTING AND CONSTRUCTION SCHEDULE

Construction of the Energy Center is expected to begin in March of 2005 with commercial operation commencing between August 2005 and November of 2005. A schedule for permitting and construction of the Energy Center is included in Appendix C.

The regulatory review process to obtain a CPCN from the PSC is considered the critical path item determining the construction schedule.

## 1.20 CONSTRUCTION ACTIVITIES

Construction of a wind energy project is unique relative to most other energy projects because it is not located within a single fenced site. Rather, it consists of many smaller work sites over a much larger area. The construction process is initially focused on building the roads to access each turbine site and the foundations to support the equipment. The construction process then shifts to the installation of the turbine components with large cranes. Much of the effort involves the logistics of managing activities over a large area and the delivery of equipment to each turbine site. It is anticipated that the overall construction activities for the Energy Center will include the following:

1. Prepare access roads to turbine locations.

2. Clear and grub, as necessary, the turbine foundation locations.
3. Excavate turbine location areas for foundations.
4. Install forms and rebar and place concrete foundations.
5. Install the grounding system.
6. Trench for and place underground collection system cable and communication lines between turbine locations.
7. Complete road upgrade to each turbine area for crane travel.
8. Complete needed crane pads and staging area at each turbine location.
9. Deliver and assemble the tower and turbine components.
10. Make terminations of collection and communication system cables.
11. Startup and commission each wind turbine generator.
12. Reclaim any roads or crane pads after construction that will not remain for operation.
13. Restore any areas disturbed by construction.

The collection system will be installed using a trenching machine that will impact a path approximately 8-feet wide. The width of this path accommodates the trenching machine and a lead vehicle with cable reel). This trenching system will install the collection system in one continuous operation and can be accomplished, in most cases, without major disturbances other than the trench itself, which is approximately 9 to 12 inches wide. Figure 14 provides a photograph of a typical trenching machine for use in this type of installation. Forward Energy will avoid impacts to wetlands and waterbodies by boring under such areas when installing the collection system. Additional extra work space will be required at both the entry and exit position of the bore and is anticipated to be approximately 60 feet x 60 feet in size.

The substation and any O&M building construction will be conducted concurrent with the wind turbine construction, and will be completed to support commissioning of the wind turbines.

Each turbine site will typically have a laydown area and crane pad area to facilitate construction. The crane pad is a compacted area of approximately 40 to 60 feet where the crane will sit while making the lifts to assemble the wind turbine. Compaction of the ground at the crane pad is necessary so that the ground does not settle causing the crane to become unstable. The laydown and crane pad areas will either remain in tact or be restored back to their original condition upon the completion of construction. The exact dimensions of these areas will be finalized as part of the final design of the project. The laydown and crane pad areas will be determined by component delivery sequence, types of cranes used, and construction sequence used by the contractor (i.e. some contractors install the blades to the hub and lift the entire assembly, others install the hub to the nacelle and then lift each blade individually). Figure 15 provides a

photograph of a typical construction spread. In some instances the crane may travel from one location to another across a field where the distance may be significantly shorter than by road. Travel across agricultural fields will only occur with owner permission and any soil compaction will be mitigated as required.

A typical construction sequence for a single turbine includes the following:

1. Clear turbine area and prepare access road to turbine area.
2. Excavate for turbine foundation.
3. Form for turbine foundation and set anchor bolts and rebar.
4. Place concrete for foundation.
5. Backfill of the area around the foundation.
6. Set base tower section including grouting and including any required tensioning of anchor bolts (if necessary). This step involves leveling and shimming of the section.
7. Locate equipment in base of tower, switchgear and controller.
8. Set remaining tower sections; lower mid, upper mid and top.
9. Set Nacelle and Hub on top of tower (pending contractor preference).
10. Lift and connect the three blades (pending contractor preference).
11. Place electric cable from generator in the nacelle to the switchgear at the base.
12. Complete electrical and mechanical installation of the systems.
13. Commission the turbine.

The wind turbine sites will be accessed from the main roads via newly constructed gravel roads. The gravel access roads will typically be approximately 15 feet wide for the primary travel path, but may be up to 25 or 30 feet wide during the construction phase to allow passage of the large cranes needed to erect the turbines. Typically, construction of a single turbine foundation can take approximately five days. Following foundation completion, erection of the turbine can be expected to take two to three days. Depending upon the construction sequence at the Project Area, delivery of equipment and materials and contractor preference, there may be a time lag between foundation completion and turbine assembly.

Some modifications to the specific location of the wind turbines, and associated auxiliary facilities may be required during construction activities due to unforeseen obstacles, engineering constraints, optimization of construction and to minimize impact on the surrounding areas. Therefore, the exact location of the temporary laydown areas, extra workspace and access roads cannot be determined at this time. Modifications are not expected to cause significant changes in the needs or construction sequence at any single turbine location.

### 1.21 HAZARDOUS CHEMICALS

Hazardous chemicals will not be used on site during construction and operation of the Energy Center.

The wind turbines will require lube oil during operation. Lubricants will be stored onsite within a containment area inside or adjacent to the O&M building. The amount of lube oil held on site will fluctuate; however, it is anticipated there will be up to 1,000 gallons in large totes stored onsite. In the event of spillage during operation of the wind turbine, the nacelle will act as spill containment.

A Spill Pollution Containment Control (SPCC) plan is required for oil and oil products with (1) any single oil aboveground storage tank (AST) exceeding 660 gallons, (2) a total AST capacity exceeding 1,320 gallons, or (3) a total underground storage tank (UST) capacity exceeding 42,000 gallons. Forward Energy will not exceed the quantities for oil and oil products as listed above and therefore a plan would not be required.

Where possible, fueling of vehicles will take place off-site at commercial fueling facilities. Where on-site refueling is required, appropriate control measures, including providing secondary containment and spill control materials, will be implemented. Appropriate safety related equipment such as eye wash stations, first aid kits, and fire extinguishers will also be provided.

## 2.00 NATURAL AND COMMUNITY RESOURCES, DESCRIPTION AND POTENTIAL IMPACTS

This section describes the existing natural and community resources of the Project Area and provides a description of the potential impacts to those resources.

### 2.01 MAPS

Several maps have been developed to depict the natural and community resources of the Project Area. These include:

- Figure 8 (A-B) identifies the Energy Center on a United States Geological Survey (USGS) topographic quadrangle map. The figure depicts the location of the facility relative to geographic features including nearby highways, roads, and cities and includes section numbers. This figure includes a ½-mile radius surrounding the Project Area.

- Figure 16 (A-B) identifies the existing zoning within the Project Area and a ½-mile radius.

- The existing land use in the Project Area is depicted on Figure 17 (A-B).

- A general soil survey map for the Project Area is provided as Figure 18.

- Figure 19 (A-B) includes Wisconsin Wetland Inventory (WWI) maps from the WDNR. This figure also includes a ½-mile radius surrounding the Project Area.

- Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRM) for the project is included as Figure 20. As shown on this figure, a floodplain area begins in the southeast corner of the Project Area and extends northwest ending just south of the Village of Brownsville. Five additional floodplain areas are located in the northern portion of the Project Area within the ½ mile buffer. A large floodplain area, the Horicon National Wildlife Refuge, is located to the west of the Project Area. A very small portion of this floodplain enters into the ½ mile buffer of the Project Area in Section 20, T13N, R16E. All floodplains located within the Project Area and ½ mile buffer are designated Zone A, an area of 100-year flood. Base flood elevations and flood hazard factors are not determined for these areas. No wind turbine sites are located within an area designated as floodplain.

## 2.02 AERIAL PHOTOGRAPHS

Figure 21 (A-D) identifies the proposed Project Area on aerial photography and includes a 1/2-mile boundary surrounding the Project Area. The aerial photographs for Dodge County were taken in 1999 and for Fond Du Lac County in 2000. The aerial photos have been updated with additional structures identified during field reconnaissance conducted during 2004. This figure also identifies a 1,000 foot buffer around each structure.

## 2.03 TOWNSHIP, RANGE AND SECTION

The following table identifies the location of the Energy Center and all auxiliary facilities by Township, Range and Section.

**Table 1**

**Township, Range and Section of Proposed Energy Center and all Auxiliary Facilities**

| TOWNSHIP | RANGE | SECTION | NEAREST ¼ ¼ SECTION |
|---|---|---|---|
| **Fond Du Lac County** | | | |
| 14N | 16E | 25 | NW/SE, NE/SW, SW/NW, SW/NE, SE/NW, SE/SW |
| 14N | 16E | 26 | NW/SW, NE/NE, NE/SE, SW/NW, SW/NE, SE/NW, SE/NE, SE/SW |
| 14N | 16E | 34 | SW/NE, SW/SE, SE/NW, SE/NE, SE/SE |
| 14N | 16E | 35 | NW/NW, NW/SW, NW/SE, NE/NW, NE/NE, NE/SW, NE/SE, SE/NE, SE/SW, SE/SE |
| 14N | 16E | 36 | NW/NW, NW/NE, NW/SW, NW/SE, SW/NE, SW/SE, NE/SW, NE/SE, SE/NE, SE/SE |
| 14N | 17E | 27 | NW/SW, SW/NW, SW/SW, SW/SE |
| 14N | 17E | 28 | NW/SE, NE/NW, NE/NE, NE/SW, NE/SE, SW/NE, SE/NW, SE/NE, SE/SW, SE/SE |
| 14N | 17E | 29 | NW/SE, SW/NE, SW/SE |
| 14N | 17E | 30 | NW/NW, NW/NE, NE/SW, NE/SE, SW/NE, SW/SE, SE/NW, SE/SW, SE/SE |
| 14N | 17E | 31 | NW/NE, NW/SW, NW/SE, NE/SW, NE/SE, SW/NW, SW/NE, SW/SE, SE/SW |
| 14N | 17E | 32 | NW/NE, NW/SW, NW/SE, NE/SW, NE/SE |
| 14N | 17E | 33 | NW/NE, NW/SW, NW/SE, NE/NW, NE/SW, NE/NE, NE/SE, SW/NE, SW/SE, SE/NE, SE/SE |
| 14N | 17E | 34 | NW/NW, NW/NE, NW/SW, NW/SE, SW/NW, SW/NE, SW/SW, SW/SE |
| **Dodge County** | | | |
| 13N | 16E | 1 | NW/NE, NW/SW, NW/SE, NE/NW, NE/NE, NE/SW, SW/NW, SW/SW, SE/NW, SE/SW, SE/SE |
| 13N | 16E | 2 | NW/NW, NW/NE, NE/NW, NE/NE, NE/SW, NE/SE, SW/SE, SE/NW, SE/SW |
| 13N | 16E | 3 | NW/NE, NW/SE, NE/NE, NE/SE, SW/NW, SW/SW, SW/SE, SE/NE, SE/SW, SE/SE |
| 13N | 16E | 10 | NW/NW, NW/NE, NW/SE, NE/NW, NE/NE, NE/SW, NE/SE, SW/NW, SW/NE, SW/SW, SW/SE, SE/NW, SE/SW, SE/SE |
| 13N | 16E | 11 | NW/NE, NW/SE, NE/NW, NE/SW, SE/NW, SE/SW |
| 13N | 16E | 12 | NW/NW, NW/NE, NW/SW, NW/SE, NE/NW, NE/NE, NE/SE, SW/NW, SW/NE, SW/SE, SE/NW, SE/NE, SE/SE |
| 13N | 16E | 13 | NW/NE, NW/SE, NE/NE, NE/SW, NE/SE, SW/NW, SW/NE, SW/SW, SE/NE, SE/SW, SE/SE |
| 13N | 16E | 14 | NE/NW, NE/SW, SW/NW, SW/SW, SE/NE, SE/SW, SE/SE |
| 13N | 16E | 15 | NW/NE, NW/SE, NE/NW, NE/SW, SW/NE, SW/SE, SE/NW, SE/NE, SE/SW, SE/SE |

| TOWNSHIP | RANGE | SECTION | NEAREST ¼ ¼ SECTION |
|---|---|---|---|
| 13N | 16E | 22 | NW/NE |
| 13N | 16E | 24 | NE/NW, NE/NE, NE/SW, NE/SE |
| 13N | 17E | 3 | NW/NW, NW/NE, NW/SE, SW/NE, SW/SW, SW/SE |
| 13N | 17E | 4 | NW/NW, NW/SW, NW/SE, NE/NW, NE/NE, NE/SW, NE/SE, SW/NE, SW/SE, SE/NW, SE/NE |
| 13N | 17E | 6 | NW/NW, NW/NE, NE/NW, NE/SW, SW/NE, SW/SE |
| 13N | 17E | 7 | NW/NE, NW/SE, NE/NW, NE/SW, SW/NE, SW/SE |
| 13N | 17E | 9 | NW/NE, NW/SE, SW/NE, SW/SE, SE/NW, SE/SW |
| 13N | 17E | 16 | NW/NW, NW/NE, NW/SE, NE/NE, NE/SW, NE/SE |
| 13N | 17E | 19 | NW/NW, NW/NE, NW/SW, NW/SE, SW/NW, SW/NE |

One new interconnection substation will be located at T14N, R17E NE/SE of Section 33.

## 2.04 HISTORY OF SITE

The majority of the Project Area consists of land currently being used for agricultural purposes. Forward Energy consulted with landowners within the Project Area to identify potential sources of contamination and determine previous uses of the property.

The Registry of Waste Disposal Sites in Wisconsin was reviewed to determine the potential for previous site contamination in the Project Area. Table 2 identifies the waste disposal areas within the Project Area and within the ½-mile buffer of the Project Area:

**Table 2**
**Waste Disposal Sites in Project Area and ½ Mile Buffer**

| FACILITY NAME | LEGAL DESCRIPTION | COMMENTS |
|---|---|---|
| Grande Cheese Company | SW NW S12 13N 16E | Near wind turbine #68 and #70 on the east side of Dairy Road |
| Town of Leroy | SW NW S12 13N 16E | Near wind turbine #68 and #70 on the east side of Dairy Road. |
| Village of Brownsville | NE SW S08 13N 17E | Wind turbines are currently not sited here. |
| Western Lime and Cement Company | SW NE S18 13N 17E | Wind turbines are currently not sited here |
| Majerus Landfill | NW NW S35 14N 17E | Within 1/2 mile buffer of Project Area |
| Town of Byron | S23 14N 17E | Within 1/2 mile buffer of Project Area |
| Village of Oakfield | SW NW S22 14N 16E | Within 1/2 mile buffer of Project Area |

Landowners have indicated the primary use of land in the area has historically been for agriculture.

## 2.05 LAND OWNERSHIP AND ACQUISITION

Forward Energy has obtained easements from landowners regarding 94 wind turbines. Forward Energy is currently discussing with individual landowners the potential to obtain easements on their properties for construction and operation of additional turbines. Forward Energy anticipates attaining easements for all turbines by December 2004. These easements will provide Forward Energy the required land for a period of 30 years with an option to extend the easement an additional 20 years. Landowners will be compensated for the loss of crops during construction activities and will be provided compensation annually for permanent crop loss based on the land occupied by the Energy Center. Easement payments will be provided yearly per turbine regardless of the selected type of turbine or megawatt size.

According to the agreements with each host landowner, upon termination of the easement, Forward Energy shall remove any foundations, aboveground and belowground (to a depth of four (4) feet below grade) and remove other Energy Center structures from the property. The areas disturbed will be restored to a condition reasonably similar to their original condition. Reclamation will include, as reasonably required, leveling, terracing, mulching and other reasonably necessary steps to prevent soil erosion.

## 2.06 ZONING ORDINANCES

The Project Area is located within portions of Fond Du Lac and Dodge County, Wisconsin. Table 3 identifies the municipalities located within the Project Area and ½-mile buffer. This table also identifies whether or not applicable local plans or zoning ordinances have been adopted by each municipality and provides the name of the entity responsible for zoning changes. Copies of applicable zoning ordinances are provided in Appendix D.

**Table 3**
**Land Use Plans and Zoning Ordinances**

| MUNICIPALITY | LAND USE PLANS (Y/N) | ZONING ORDINANCES (Y/N) | ENTITY RESPONSIBLE FOR ZONING CHANGES |
|---|---|---|---|
| **Fond Du Lac County** | N | N | Town Offices |
| Town of Byron | N | Y (1976) | Town of Byron |
| Town of Oakfield | N | Y | Town of Oakfield |
| Village of Oakfield | N | Y | Village of Oakfield |
| **Dodge County** | Y | Y | Dodge County |

| MUNICIPALITY | LAND USE PLANS (Y/N) | ZONING ORDINANCES (Y/N) | ENTITY RESPONSIBLE FOR ZONING CHANGES |
|---|---|---|---|
| Town of LeRoy | N | N | Dodge County |
| Town of Lomira | N | N | Dodge County |
| Village of Brownsville | Inactive (1977) | Y (1978) | Village of Brownsville |
| Village of Lomira | Y (1990) | Y (1981) | Village of Lomira |
| Note: Active plans are plans that have been adopted or updated within the last 10 years. In-active plans are plans that have not been updated within the past 10 years. | | | |

A map identifying the zoning of the Project Area is provided as Figure 16 (A-B). The Forward Energy Center is located in areas primarily zoned as either General Agriculture (A-1) or Prime Agricultural (A-2).

**Fond Du Lac County**

Fond Du Lac County does not have any zoning ordinance or land use plan. All zoning issues are handled at the town level.

*Town of Byron*

The Town of Byron is currently developing a Comprehensive Plan and updating its zoning maps. Both are anticipated to be completed by January 2005.

*Town of Oakfield*

The Town of Oakfield has a zoning ordinance dated March 13, 2000. District regulations and standards are included within the ordinance for each of the zoning designations within the Town and allows for Special Uses.

*Village of Oakfield*

The Village of Oakfield has a zoning ordinance dated December 10, 1982. District regulations and standards are included within the ordinance for each of the zoning designations within the Village and allows for Special Uses. The Department of Agriculture, Trade and Consumer Protection (DATCP) must be notified of all rezoning. Based on the conceptual site layout of the wind turbines, the project will not enter into the jurisdictional boundaries of this municipality.

**Dodge County**

According to the *Land Use Code of Dodge County, Wisconsin*, the only municipalities within the Project Area that have individual land use plans or zoning ordinances include Dodge County, Village of Brownsville and the Village of Lomira. The Town of Lomira is in the process of developing a smart growth comprehensive plan. The Town recently adopted a zoning ordinance, formed a planning department, and had its first planning meeting approximately four months prior

to the submittal of this CPCN application. The plan and zoning ordinances have an implementation target date of 2006. Currently all land use and zoning issues are being handled by Dodge County.

Power generation and transmission is conditionally allowed in Dodge County in areas zoned as Extensive Commercial (C-2), Light Industrial (I-1), Industrial (I-2), Prime Agricultural (A-1), General Agricultural (A-2) and Wetland (WL) districts. Dodge County created a Wind Energy System Overlay District to ensure the regulation of wind energy system facilities in Dodge County. A copy of Section 4.11 Wind Energy System Overlay District is provided as Appendix D.

*Village of Brownsville*

The Village of Brownsville is located at the crossroads of State Highway 49, County Road AY/Y and Center Drive in the northwest corner of the Town of Lomira.

According to the *Land Use Code of Dodge County, Wisconsin* the Village of Brownsville has a Land Use Plan that was developed in 1977. Due to the age of this plan it is considered inactive. The Village of Brownsville had adopted its zoning ordinance in 1978. The zoning ordinances and comprehensive plan are currently being updated.

*Village of Lomira*

The Village of Lomira is located at the crossroads of State Highways 49, 67 and 175, and U.S. Highway 41 in the east-central location of the Town of Lomira.

The Village of Lomira is governed by an elected president and six trustees, which make up the village board. The Village Planning Commission includes the village president, two trustees and four citizen members. This commission maintains a master plan for village expansion and future development.

## 2.07 ZONING AND LAND USE CHANGES

Conditional Use and Special Use Permits may be sought for the construction of the Energy Center. Areas surrounding each wind turbine used during construction will be restored after construction.

Forward Energy is currently working with each of the municipalities within the Project Area to provide details of the project to address local requirements.

## 2.08 EXISTING LAND USE

The majority of the Project Area (96.55%) is farmland (tilled agriculture and hayfields), with forested patches and strips/tree rows throughout. There is some residential housing in the area. Figure 17 (A-B) provides a figure identifying the land classifications within the Project Area. The following table provides acreages for each land use or land-cover in the Project Area.

**Table 4**
**Land Use in the Project Area**

| LAND USE CODE | ACREAGE | PERCENT OF PROJECT AREA |
|---|---|---|
| Open Water | 5.1 | 0.02 |
| Low Intensity/Residential[2] | 64.5 | 0.20 |
| High Intensity/Residential [1] | 20.9 | 0.06 |
| Commercial/Industrial/Transportation | 9.3 | 0.03 |
| Bare Rock/Sand/Clay | 2.4 | < 0.01 |
| Quarries/Strip Mines/Gravel Pits | 80.5 | 0.25 |
| Deciduous Forest | 702.2 | 2.17 |
| Evergreen Forest | 8.5 | 0.03 |
| Grasslands/Herbaceous | 46.5 | 0.14 |
| Pasture/Hay | 14,740.5 | 45.48 |
| Row Crops | 16,553.9 | 51.07 |
| Small Grains | 17.8 | 0.05 |
| Urban/Recreational Grasses | 2.7 | < 0.01 |
| Wooded Wetlands | 139.0 | 0.43 |
| Emergent Herbaceous Wetlands | 18.4 | 0.06 |
| **TOTAL ACREAGE** | **32,412.20** | |

After the wind turbines have been erected, the land surrounding the turbine will be restored. The site roads will be maintained at a width of approximately 15 feet for continued access. The majority of other roads, road shoulders, crane travel paths, crane pads, and laydown areas will be restored to their original use.

[2] Residential land uses range from high density, represented by multiple-unit structures of urban cores, to low density, where houses are in lots of more than an acre, on the periphery of urban expansion.

*Airports*

Federal Aviation Administration (FAA) regulations on obstructions to navigable airspace (14 CFR 77) require notification of the FAA Administrator of any proposed construction "of more than 200 feet in height above the ground level at its site [Section 77.13(a)(1)]." The regulations also require notifying the Administrator of any proposed structure whose height exceeds an imaginary surface extending 20,000 feet from the nearest airport runway at a slope of 100 feet horizontal to each 1-foot vertical. If the structure is within 10,000 feet of an airport's runway and the airport's longest runway is no greater than 3,200 feet, the slope is reduced to 50 to 1 [Section 77.13(a)(1)(i)].

Under Wisconsin statutes, the Wisconsin Department of Transportation (WisDOT) has certain responsibilities concerning new construction of high structures near airports [Section 114.135(7)]. WisDOT requires a permit for new structures over 500 feet in height within 1 mile of an airport or structures above a height determined by the ratio of one foot vertical to 40 feet horizontal measured from the nearest public airport within the state. For structures of less than 150 feet in height, no permit is required.

Six civil airports open for public use, were identified within a 20-mile radius outside of the Project Area boundary. Table 5 identifies these airports:

**Table 5**
**Airports within 20-Miles of Project Area**

| AIRPORT NAME | LOCATION | RUNWAY LENGTH (FT.) | APPROXIMATE DISTANCE FROM PROJECT AREA |
|---|---|---|---|
| Fond Du Lac County Airport | Fond Du Lac County | 5,900 | 7 Miles North |
| Wittman Regional Airport | Oshkosh | 8,000 | 20 Miles North |
| Dodge County Airport | Juneau | 5,000 | 11 Miles Southwest |
| Hartford Municipal Airport | Hartford | 3,000 | 14 Miles Southeast |
| West Bend Municipal Airport | West Bend | 4,400 | 19 Miles Southeast |
| Hahn Sky Ranch | West Bend | 2,900 | 11 Miles Southeast |

Each airport, with the exception of Hahn Sky Ranch, is paved and has an officially published instrument approach procedure. The nearest public-use airport is the Fond Du Lac County Airport located approximately 7 miles north of the Project Area. Some landing strips are located within the Project Area, but are not covered under the FAA or WisDOT regulations.

The Energy Center will consist of wind turbines with a maximum height of 480 feet. In addition, construction of the turbines will require the installation of cranes that will extend to the hub height or greater. Based on the location of the public airports in the vicinity of the project and Federal and State regulations, Forward Energy center will notify the FAA 30 days prior to beginning construction. A permit from the WisDOT will not be required.

Both the FAA and WisDOT will be consulted to determine the appropriate lighting for the Energy Center. Considerations will be made to reducing the potential impact to migratory birds and bats and to develop a pattern that will produce adequate lighting while minimizing aesthetic impacts.

## 2.09 SITE TOPOGRAPHY

The general topography of the Project Area was reviewed based on topographic maps. The western side of the Project Area borders a ridge at an elevation of at least 1,000 feet mean sea level (msl). The Project Area is gently rolling and with elevations ranging from 1,000 feet msl to 1,150 feet msl.

Minimal grading will be necessary to level the foundation area for each wind turbine base. There is no expected change to site topography due to grading activities.

## 2.10 GEOLOGY

Geology and mining operations were investigated to ascertain the geologic makeup of the area surrounding the proposed Energy Center. The proposed Energy Center is located along the Niagra Escarpment on the edge of a thick series of dolomite layers of Silurian age. The Niagara Escarpment is a landform called a *cuesta*, and includes a layer of bedrock made up of limestone cliffs and talus slopes. The rocks are resistant to erosion and stand up in relief as a prominent line of bluffs. The endurance of this landform is attributed to Silurian limestone and dolomite.

The main ingredient of the escarpment, dolomite, was formed by calcium and magnesium carbonate deposited from decomposing shells and skeletons of primitive sea life during the Silurian age (over 400 million years ago). As the Paleozoic Era (600 to 280 million years ago) proceeded, each new layer of sediment was deposited, causing the basin to gradually sink in the middle, and form the sedimentary rock that we see today. The shallow seas slowly evaporated leaving behind thick deposits of gypsum and salt, the weight of which caused the crust to sink even more. A process called reflux filled the basin many more times, only to evaporate each

time in the subtropical sun. Under what are now the state of Michigan and Lakes Huron, Erie, and Michigan, the Niagara Escarpment subsided, causing a bending of the bedrock near its margins. The edges of this material were forced to the surface, forming an escarpment at each end (in Wisconsin and New York).

A layer of soft, impermeable layer called Maquoketa shale lies beneath the Oakfield Ledge. It was formed during the Ordovician Period (about 500 million years ago) by great thickness of mud which washed in due to erosion from the Appalachian Mountains as they rose to the east. Today, the shale erodes quickly where it is exposed, allowing the dolomite to continually break off and form a new cliff face. It is in part because of this relatively soft shale layer that Horicon Marsh was later formed by glacial action.

The escarpment is located on the eastern edge of Horicon Marsh and extends south to the town of Iron Ridge located approximately 10 miles south of the Energy Center Project Area. Further south, the escarpment is buried by glacial deposits and disappears as a surface feature. To the north of Horicon Marsh, it reaches into the town of Oakfield and continues all along the eastern shore of Lake Winnebago to Green Bay and Door County. In Wisconsin the Niagara Escarpment extends for a distance of approximately 230 miles.

Glacial drift of up to 100 feet thick overlies parts of the Oakfield Ledge with its probable karst-like surface on the Niagara dolomite bedrock filling many old river valleys, sink holes, and other highly weathered and fractured geologic features.

To assure proper support for the wind turbine foundation, Forward Energy plans to conduct geotechnical borings at or near each proposed turbine location.

There is an estimated 2,500 to 3,000 mine sites within the state. Most of the mines are rock quarries and gravel pits. None of the mines produce metal. The following table identifies the 11 active mines within the Project Area and ½-mile buffer.

**Table 6**
**Active Mines Within Project Area and ½-Mile Buffer**

| MINE NAME | OPERATOR | LOCATION |
|---|---|---|
| **Dodge County** | | |
| Farmorsville Quarry | Halquist Stone Company, Inc. | Town of Leroy - N9853 County Road V |
| Nasbro Quarry | Western Lime Corporation | Town of Lomira – County Road H:<br>PID 030-1317-1824-001<br>PID 030-1317-1833-006<br>PID 030-1317-1842-000<br>PID 030-1317-1834-000<br>PID 030-1317-1831-000 |
| Farmorsville Quarry | Western Lime Corporation | Town of Lomira – Farmorsville Road |
| **Fond Du Lac County** | | |
| Kollman Property | Linck Aggregates, Inc. | Town of Oakfield – Section 34 SW NW |
| Malterer Property | Redrock Acres | Town of Oakfield – Section 27 SE SE |
| Oakfield Quarries #1 & 2 | Buechel Stone Corporation | Town of Oakfield, Highland Road – Section 27 NE SW |
| Oakfield Quarry | Eden Stone Co., Inc. | Town of Oakfield, Breakneck Road – Section 27 SW SE |
| Oakfield Section 27 Site | Oakfield Stone Company | Town of Oakfield – Section 27 NW SW |
| Oakfield Section 34 Site | Oakfield Stone Company | Town of Oakfield – Section 34 NE NW |
| Pomering Property | Lefeber Stone, Inc. | Town of Oakfield – N2702 Centerline Road, Section 33 SE NE |
| Majerus Property | Phil Majerus | Town of Byron – Section 35 SW NW |

The construction and operation of the Energy Center will not impact mining operations within the area.

## 2.11 SOILS

Soils in the Project Area were investigated to determine their composition, properties and construction potential. The general soil types for the Project Area are discussed below and are shown in Figure 18.

Within Dodge County, three soil associations are within the Project Area: Theresa-Lamartine-Hochheim, St. Charles-LeRoy-Lomira, and Houghton-Pella. The following describes each of these soil associations and are excerpts from the U.S. Department of Agriculture (USDA) Soil Conservation Service (SCS), *Soil Survey of Dodge County, Wisconsin*.

The Project Area is located in an area dominated by Theresa-Lamartine-Hochheim association: Deep, nearly level to steep, well drained and somewhat poorly drained soils that have a silty and loamy subsoil; formed in loess and glacial till. This association is on ground moraines, drumlins, and foot slopes of drumlins that are characterized by even slopes of medium length. This association makes up about 25 percent of Dodge County. The association consists of about 25 percent Theresa soils, 10 percent Lamartine soils, 9 percent Hochheim soils and 56 percent soils of minor extent.

Theresa soils are gently sloping to steep. They are well drained. Permeability is moderate or moderately slow.

Lamartine soils are nearly level and gently sloping. They are somewhat poorly drained. Permeability is moderate.

Hochheim soils are gently sloping to steep. They are well drained. Permeability is moderate or moderately slow.

The minor soils in this association are the poorly drained Pella soils, the moderately well drained Mayville soils, and the well drained Dodge, Knowles, LeRoy, McHenry and Miami soils. In cultivated areas the main concerns of management for Theresa and Hochheim soils are controlling erosion and maintaining good soil tilth. Theresa and Hochheim soils that have slopes of less than 6 percent have mainly good potential for sanitary facilities and building site development. Lamartine soils have poor potential for these uses.

The second most predominant soil is St. Charles-LeRoy-Lomira association: Deep, nearly level to steep, well drained and moderately well drained soils that have a silty and loamy subsoil; formed in loess and glacial till. This association is on ground moraines and drumlins that are characterized by medium and long, even slopes. This association makes up about 11 percent of the county. It is about 35 percent St. Charles soils, 30 percent LeRoy soils, 20 percent Lomira soils, and 15 percent soils of minor extent.

St. Charles soils are nearly level to sloping. They are well drained and moderately well drained. Permeability is moderate.

LeRoy soils are gently sloping to steep. They are well drained and permeability is moderate.

Lomira soils are gently sloping and sloping. They are well drained. Permeability is moderate.

The minor soils in this association are the very poorly drained Houghton and Palms soils, the somewhat poorly drained Elburn soils, and the well drained Fox, Markesan, and Mendota soils. In cultivated areas, the main concerns for management are controlling erosion ad maintaining good soil tilth. Houghton and Palms soils need to be drained if they are to be used for crop production. Elburn soils also need drainage for dependable crop production. The major soils that have slopes of less than 6 percent have mainly good potential for sanitary facilities and fair potential for building site development.

A small area in the far southwest corner of the Project Area is the Houghton-Pella association: Deep, nearly level, very poorly drained and poorly drained organic soils and soils that have a silty subsoil; formed in decomposed sedges and reeds or in silty material and glacial drift. In cultivated areas, the main management concern is drainage. If drained, Houghton soils are subject to subsidence, blowing, and burning. Controlled drainage is necessary to reduce subsidence and blowing in spring and fall. In addition to drainage, Pella soils need management to maintain good soil tilth. The major soils of this association have poor potential for sanitary facilities and building site development. Although this soil association is located within the Project Area, there are no wind turbine sites located within this area.

In the Fond Du Lac portion of the Project Area there are two soil associations: Lomira-Virgil and Beecher-Elliott. The following describes each of these soil associations and are excerpts from the USDA-SCS, *Soil Survey of Fond Du Lac County, Wisconsin.*

The majority of the Project Area within Fond Du Lac County includes the Lomira-Virgil association: Well-drained and somewhat poorly drained, silty, moderately permeable soils. This association is part of a ground moraine underlain by calcareous loam glacial till. The landscape is mostly one of low ridges and knobs, and between the ridges, nearly level uplands and depressions. This association makes up about 24 percent of Fond Du Lac County, and is about 60 percent Lomira soils, 15 percent Virgil soils, and 5 percent Pella soils. The remaining 20 percent is Palms, Rollin, and Houghton soils.

Lomira soils are nearly level to moderately steep, deep, and well drained. They formed in silt over glacial till of loam texture. Virgil soils are nearly level and somewhat poorly drained. They are in or adjacent to wide depressions and low areas and are subject to occasional flooding.

Pella soils are nearly level to gently sloping, and they are poorly drained. This association is used mainly for crops. Limitations are slight to moderate. Wetness is the main limitation for the

Virgil and Pella soils. Before cultivation, the Lomira soils supported forests of oak, sugar maple, and basswood. Marsh grass and shrubs grew on the other soils.

The other soil association is the Beecher-Elliott association: Somewhat poorly drained, silty and clayey, moderately slowly permeable soils. This association occupies a ground moraine of calcareous clay loam to silty clay glacial till that has high shale content. The landscape is one of nearly level to moderately steep uplands, nearly level depressions, waterways, and broad lowlands. This association does not have a mature or well-defined drainage pattern. This association makes up about 6 percent of Fond Du Lac County. It is about 30 percent Beecher soils, 20 percent Elliott soils and 15 percent Morley soils. The remaining 35 percent is Ashkum, Pella, Morley, Poygan, Houghton, Manawa, and Lomira soils.

Beecher soils are nearly level and gently sloping and have a thin, dark-colored surface layer. They formed in less than 24 inches of silty soil underlain by calcareous clay loam and silty clay glacial till.

Elliott soils, also, are nearly level and gently sloping. They have a thick, dark-colored surface layer. They formed in silty soil materials, less than 24 inches thick, which is underlain by calcareous clay loam and silty clay glacial till.

Ashkum and Pella soils are nearly level and occur in shallow drainage ways and wide, wet areas.

Morley soils are gently sloping to moderately steep and have a light-colored surface layer. Most areas are used for crops. A few are used as permanent pasture and woodlots, or are idle.

Prairie grasses and sparse stands of oak and hickory were the original vegetation on Beecher and Elliott soils. Marsh grasses and other water-tolerant plants grown in undisturbed areas of Ashkum and Pella soils.

Soil compaction occurs when soil particles are pressed together, limiting space for air and water. The amount of water is a critical factor in soil compaction potential. A dry soil, which has friction between the soil particles, is less likely to become compacted. Water acts as a lubricant between the particles, making the soils easier to compact.

A soil erosion and sediment control plan will be developed by Forward Energy and utilized during construction of the Energy Center. Should mitigation be required for soils in the area, the soil erosion and sediment control plan will be used for guidance. In addition, geotechnical

borings will be obtained at or near each turbine site to determine the stability of soils for the turbine base.

## 2.12 EXISTING VEGETATIVE COMMUNITIES

Dodge County is the state's leading producer of green peas, sweet corn for processing and corn for silage. Dodge County also ranks forth in the state for total number of cattle and calves, and fifth for hogs and pigs. Fond Du Lac County is one of the leading dairy counties of the State.

The Project Area consists primarily of tilled agricultural fields (corn, alfalfa, hay), small tracts of old field/fallow field, tree rows, forest patches, regularly mowed lawn grasses and landscaped areas, irregularly mowed grassy areas, and predominately emergent wetlands.

While a small portion of farmland will be taken out of production for development and operation of the proposed Energy Center, it is not likely to impact current farming and agricultural practices.

## 2.13 THREATENED AND ENDANGERED SPECIES

Forward Energy requested information about federal and state-listed threatened and endangered species and their habitats from the United States Fish and Wildlife Service (USFWS), and WDNR. Information was also obtained through proactive avian and bat assessments conducted for the Project Area.

A letter was submitted to the USFWS and the WDNR to obtain information on federally-listed and state-listed threatened and endangered species and their habitats in the Project Area. In a response from the USFWS dated July 16, 2004, the agency noted occurrence of the following threatened or endangered species in Fond Du Lac and Dodge Counties:

**Table 7**
**Federally-Listed Threatened and Endangered Species**

| CLASSIFICATION | COMMON NAME | SCIENTIFIC NAME | HABITAT |
|---|---|---|---|
| Threatened | Bald eagle | Haliaeetus leucocephalus | Breeding (Dodge County Only) |
| Threatened | Whooping crane | Grus americana | Open Wetlands and Lakeshores (Fond Du Lac and Dodge Counties) |

However, according to the USFWS there are no known federally-listed threatened or endangered species or critical habitat present in the Project Area. The agency requested the following areas be considered when siting the wind turbines:

- Horicon National Wildlife Refuge
- Sensitive natural areas located in T14N, R16E, Sections 22, 23, 27, 28, and 33 (Fond Du Lac County)
- Sensitive Natural Areas located in T13N R16E Sections 4 and 9 (Dodge County)
- Riparian and wetland corridors around Gill Creek and Kummel Creek and it flows south from Brownsville (Dodge County)
- Forested blocks and/or habitat corridors in T13N, R17E, Section 6 and 8 (Dodge County)

The USFWS was contacted via telephone to obtain clarification on the information provided in their July 16, 2004 letter. According to Ms. Leakhena Au of the USFWS, Section 22, 23, 27, 28 and 33 of T14N R16E and Section 4 and 9 of T13N, R16E include areas of fragile cliff habitats and riparian habitation. Ms. Au was not able to provide a recommended distance from the cliff but mentioned that geotechnical issues would also need to be considered in the area.

For Section 6 and 8 in T13N, R17E, Ms. Au recommended staying out of forested patches and areas that appear to have native habitat or grass lands.

Ms. Au indicated that the potential sensitive habitats do not encompass the entire section area identified in the letter and that the USFWS letter was not meant to keep the project out of the section numbers identified, but rather to recommend keeping habitat concerns in mind when siting the turbines. There are no specific species concerns in these areas.

The USFWS letter encouraged the placement of the wind turbines to potentially reduce the mortality rate of migratory and other birds and bats, but provided no specific guidance. A copy of their response letter is provided in Appendix B.

A response was received from the WDNR dated August 17, 2004. A copy of their letter is provided in Appendix B. Endangered resource information was provided for the Project Area and a two mile radius, and a five-mile radius for aquatic species. The specific location of endangered resources is sensitive information and has been redacted from the enclosed document. Listed and special concern resources recorded as occurring within or near the project site include the following:

**Table 8**
**State-Listed Special Concern Resources**

| CLASSIFICATION | COMMON NAME | SCIENTIFIC NAME | HABITAT |
|---|---|---|---|
| **Vertebrate Animals** | | | |
| Endangered | Blanchard's cricket frog | Acris crepitans hlanchardi | Marshes along rivers and river floodplains, fens, low prairies, and mud flats with abundant emergent vegetation |
| Special Concern | Black-crowned night-heron | Nycticorax nycticorax | Freshwater wetlands dominated by bulrush and cattail with small groves of alder, willow, or other brush. Their breeding season occurs from mid April through mid-September |
| Endangered | Foster's tern | Sterna forsteri | Large semi-permanent and permanently flooded wetlands that support extensive growths of cattail and hardstem bulrush. The breeding season extends from mid May to late July. |
| Special Concern | Pugnose Minnow | Opsopoeodus (Notropis) emiliae | Prefers quiet, weedy lakes, sloughs and low-gradient rivers over bottoms of mud, sand, rubble, silt or clay. Spawning occurs from mid-June through mid-July |

| CLASSIFICATION | COMMON NAME | SCIENTIFIC NAME | HABITAT |
|---|---|---|---|
| **Invertebrate Animals** | | | |
| Endangered | Midwest Pleistocene vertigo | Vertigo hubrichti | Often associated with glacial sediments but also occurs on cool limestone talus slope and cliff habitats along the Niagara Escarpment in eastern Wisconsin and on cliffs in the Driftless Area of southwest Wisconsin. |
| Special Concern | Land snail | Catinella gelida | Occurs on cliffs and talus slopes |
| Special Concern* | Land snail | Succinea bakeri | Occurs only along the Niagara Escarpment in eastern Wisconsin. It is restricted to cool limestone talus slopes, cliffs, and algific slopes often occurring with other glacial relict taxa. |
| Special Concern | Tin-lip Vallonia | Vallonia perspectiva | Occurs primarily along calcareous cliffs |
| Special Concern | Iowa Pleistocene vertigo | Vertigo iowaensis | May be found with glacial sediments and also occurs on cool limestone talus slopes on and at the base of cliff habitats of the Niagara Escarpment in eastern Wisconsin as well as on algific cliffs in the Driftless Area of southwest Wisconsin. |
| Special Concern | Honey vertigo | Vertigo tridentata | Prefers upland woods and prairies |
| **Plants** | | | |
| Threatened | Prairie milkweed | Asclepias sullivantii | Prefers moist prairies. Blooming and optimal identification period occurs from early June through mid-July |
| Threatened | Small white lady's slipper | Cypripedium candidum | Prefers calcareous wet fens and prairies. Blooming and optimal identification period occurs from mid-May through mid-June. |
| Special Concern | Rock Whitlow-grass | Draba arabisans | Prefers exposed to shaded (often white cedar) dolomite cliffs. Flowering occurs from mid-June through late July. Optimal identification period is from early July to mid-September. |

* This species is under consideration for listing as state threatened or endangered.

Special concern species are species where some problem of abundance or distribution is suspected but not yet proved. The main purpose of this category is to focus attention on certain species before they become threatened or endangered.

The Forward Energy Center will avoid placement of wind turbines along the edge of the escarpment and will utilize soil erosion control techniques around all ground disturbing activities. Based on the placement of the turbines away from the cliff edge the Land Snail (Catinella gelida), Honey Vertigo (Vertigo tridentate), Midwest Pleistocene vertigo (Vertigo hubrichti), Iowa Pleistocene vertigo (Vertigo iowaensis), Land snail (Succinea bakeri), and the Thin-lip vallonia (Vallonia perspectiva) will be avoided. In addition, the Rock whitlow-grass (Draba arabisans), which prefers dolomite cliffs, will also most likely not be impacted.

The Forward Energy Center will avoid impacts to wetlands and floodplains thus avoiding potential impact to the vertebrate animals and threatened plant species which prefer this type of moist habitat.

A Phase I Avian Risk Assessment was conducted by Curry & Kerlinger, LLC[3] in and around the Project Area to determine the potential risks to birds that may result from development and operation of the proposed Energy Center. As part of this study, the USFWS and WDNR were also consulted. According to Curry & Kerlinger, there is no indication that the Energy Center will result in biologically significant collision impacts to birds. The proximity of Horicon and Theresa Marshes to the proposed Project Area result in the presence of larger numbers of waterfowl and waterbirds in the project vicinity. However, based on the study, the number of waterfowl fatalities is not likely to be biologically significant. The fatality rates to waterbirds are not known, because no wind power sites currently exist in close proximity to a similar waterbird concentration to use as a comparison. Despite some risk to some species of birds, the overall collision risk is not likely to be biologically significant.

Based on the results of this Phase I assessment, Curry & Kerlinger derived the following conclusions:

[3] Paul Kerlinger, PhD of Curry & Kerlinger, LLC provides a variety of avian research and permitting services for the wind power and communication tower industries, as well as federal and state agencies, and non-profit environmental organizations. Paul Kerlinger received a Ph.D. in biology from the University at Albany in 1982. He taught and conducted research at the university level between 1982 and 1987, when he became the director of the New Jersey Audubon Society's Cape May Bird Observatory. He established the research program for the Society and added two new centers to New Jersey Audubon, including a new Bird Observatory building. Kerlinger served as director of the New Jersey Breeding Bird Atlas and he has published dozens of scientific articles and 5 books, including two on bird migration: *How Birds Migrate* (Stackpole Books) and *Flight Strategies of Migrating Hawks* (Chicago University Press). He also coauthored *The New York City Audubon Society Guide to Finding Birds in the Metropolitan Area* (Cornell University Press).

1. The Forward Energy Center Project Area has been highly modified by agriculture and other land uses such that high quality or important bird habitats are not present. The Project Area supports a modest array of common forest mostly edge, brushland, and grassland nesting species.

2. Nesting habitat for interior forest birds and rare grassland birds is marginal at best. There is no habitat that appears suitable for nesting by Wisconsin state or federally listed species.

3. Ownership on the Project Area is private. Land use would continue relatively unchanged (primarily farming) by the construction of wind turbines.

4. Significant hawk, songbird, waterfowl, shorebird, or other migration is not known to occur over the Project Area, although the Horicon and Theresa Marshes, about 2 to 3 miles from the Project Area are important and significant stopover sites for waterfowl and waterbirds and some of those birds are likely to fly over the Project Area or forage within the project boundary. The Project Area itself does not have any ecological magnets that would attract large numbers of migrants.

5. The habitat at the Project Area does not suggest large concentrations of wintering birds and the listed species are not likely to be present in that season.

6. The Project Area is approximately 2 miles from Horicon Marsh, a site nominated for Important Bird Area status.

7. Known and suspected risk factors at the Forward Energy Center are minimal, although the proximity of the Horicon and Theresa Marshes suggest fatalities of waterfowl and, perhaps, some other waterbirds may be above the average found for other wind power sites. Despite this elevated level of risk to some species of birds, the overall collision risk to birds is not likely to be biologically significant.

Based on the site reconnaissance, literature review, interviews, and on what has been documented about risk to birds at wind power facilities in the United States and Europe, Curry & Kerlinger offered the following recommendations to minimize potential impacts.

- Electrical lines within the Project Area should be primarily underground. Any new above ground wires at the Project Area or leading from the Project Area and substations to the grid,

should be configured per APLIC (Avian Power Line Interaction Committee, US Fish and Wildlife Service) guidelines.

- Permanent meteorology towers should be free-standing and unguyed to prevent the potential for avian collisions.

- Roads and turbine pads should be minimal in size so that a minimum amount of habitat is removed. Brush, forest, or grass/farm crops should be permitted to grow up as close to the turbines and roads as possible following construction to minimize habitat fragmentation and impact.

- FAA lighting on turbines should not include steady burning red lights (L-810) and no sodium vapor or other bright lights should be left on at night at any plant related infrastructure. FAA night lighting of turbines should be either red strobe-like lights or white strobes at night with the longest possible off cycle permissible. Lighting should be kept to a minimum number of turbines.

- Population modeling of waterbird or other species collision fatalities, via population viability analyses, would provide an indication as to whether biologically significant risk is likely to occur to some of those species.

- A post construction fatality study may be conducted to assess collision fatalities at the Project. Such a study would include one or more years of on the ground surveys of a random subset of turbines in which the numbers of birds killed are extrapolated from the actual number of carcasses found, times a multiplier that includes carcass removal rates via scavenging and the efficiency of searchers looking for carcasses. To date, only one post construction fatality study has been conducted in Wisconsin and more studies are needed to fully understand collision risk to birds.

A copy of the Phase I Avian Risk Assessment is included in Appendix E. Forward Energy anticipates conducting the recommended post-construction monitoring.

A Phase I Bat Risk Assessment was conducted by Curry & Kerlinger, LLC in and around the Project Area to determine the potential risk to bats that may result from development and operation of the proposed Energy Center. Neda Mine hibernaculum is located approximately 10 miles south of the Project Area and is home to four species of bats that are known to hibernate, forage, roost, and migrate through the general area surrounding the mine. The location of this

mine adds to the potential use of the Project Area for foraging, roosting, and migration. The fatality rates are likely to be a combination of the fairly predictable rate of fatalities to tree bats, plus the unknown risk to nearby cave bats. The primary habitat in the Project Area does not appear to be high quality for bat foraging or roosting and there is no indication that federally listed bats use or occur in the Dodge or Fond Du Lac County area.

Based on the results of this Phase I assessment, Curry & Kerlinger derived the following conclusions:

1. Seven species of bats are known to occur in the general area of the Forward Energy Center Project Area, none of which are federally endangered or threatened and only one, northern long-eared bat, is a Wisconsin species of special concern.

2. The Neda Mine, located about 10 miles south-southwest of the Project Area supports upwards of one-half million bats of four species, with little brown bats accounting for about 80% of the bats present.

3. Little is known about the actual migration or foraging patterns of bats at the Neda Mine, or about use of the Project Area by bats. Habitat at the Project Area is mostly agricultural and does not suggest good foraging or other bat habitat.

4. Bats do collide with wind turbines, with lowest fatality rates being from the western United States (~ 1 bat per turbine per year) and greatest rates being from the eastern United States (up to about 50 bats per turbine per year). Fatality rates at Wisconsin turbines have been reported at about 4 bats per turbine per year, including mostly tree bats (hoary and red bats predominated). Cave dwelling bats have been killed by turbines in smaller numbers than tree dwelling bats. It is not known why there is a difference between these types of bats.

5. Tree bats seem to collide most often with turbines during the period July through September, the time when migration of tree bats is occurring, the same time when cave bats are returning to caves and foraging and swarming near caves. It has been hypothesized that late summer migration is the riskiest period of the year and that migrating bats are at greater risk than foraging bats.

6. Methodologies for studying bat foraging and migration in the field have not been developed, so there are no quantitative ways of assessing risk in the field at this time. New technologies are being tested during the fall of 2004 at, at least, one eastern wind power site.

7. Overall risk to migrating bats was assessed to be similar to the risk demonstrated at another Wisconsin wind power site, although risk to bats that use the Neda Mine could not be determined.

Based on the literature, interviews, and comparison with other sites gathered in the development of this risk assessment, Curry & Kerlinger provided the following recommendation with respect to bat safety and risk. This recommendation is made in addition to those made in the accompanying avian risk assessment.

- A post construction study of bat fatality would be helpful to evaluate the degree of bat impacts that occur at the Forward Energy Center and whether those impacts are likely to be biologically significant. Such a study would include both the fatality study and a population viability analysis with associated sensitivity analyses. A fatality study would also provide scientific information that would be useful for determining impacts of future wind power development in Wisconsin and for evaluating cumulative impacts to bats from expansion of wind power in the state.

A copy of the Phase I Bat Risk Assessment is included in Appendix F. Forward Energy anticipates conducting the recommended post-construction monitoring.

## 2.14 ARCHAEOLOGICAL AND HISTORICAL RESOURCES

Forward Energy consulted with the State Historical Society of Wisconsin (SHSW) - Division of Historic Preservation to obtain available cultural, archaeological, and historic information contained within the Wisconsin Archaeological and Historic Resources Database (WisAHRD) for the Project Area. This information was reviewed for the Project Area to determine if potential impacts exist. Changes and updates are made to the WisAHRD and to its digital geographic datasets on a daily basis. The Division of Historic Preservation is under no obligation to provide updates of data, alterations, or accuracy errors discovered after the distribution of a geographic dataset. The absence of historic resources in a particular area does not necessarily mean that no historic properties are present. It is possible that the area in question has not been systematically surveyed for resources; or the particular search query failed to retrieve all records associated with that locality.

Forward Energy will develop an Unanticipated Finds Plan that will be kept onsite during construction activities and will include contact information for individuals at the SHSW. Should unanticipated archaeological or cultural resources be discovered during construction of the

project, Forward Energy would stop work immediately and contact the SHSW for further direction.

Consultation letters were submitted to the Bureau of Indian Affairs (BIA) Midwest Regional Office, Federally Recognized American Indian Tribes and Tribal Historic Preservation Offices in Wisconsin to determine the potential effect of the Energy Center on Native American tribes and/or reservations. A response was received from the Ho-Chunk Department of Heritage Preservation on June 14, 2004 requesting an updated archaeological survey report for any new construction sites. A letter dated September 7, 2004 was submitted to the Ho-Chunk Department of Heritage Preservation indicating that Forward Energy does not expect any impact to archaeological and cultural resources during construction and operation of the project. Should unanticipated archaeological or cultural resources be discovered during construction of the project, Forward Energy will stop work immediately and contact the SHSW for further direction. A response was also received from the Oneida Cultural Heritage Department dated June 22, 2004 stating that the proposed undertaking will not affect objects, sites, or locations of traditional religious or cultural importance to the Oneida Nation. A copy of the response letters are provided in Appendix B.

## 2.15 EMISSIONS AND DISCHARGES

Wind electric generation is a clean renewable energy source. The energy from the wind turbines is generated by harnessing the energy of the wind and converting it to mechanical and then electrical energy. There is no combustion in the wind turbine process and therefore, air emissions are not associated with the operation of the Energy Center.

## 2.16 MERCURY EMISSIONS

Mercury emissions are not associated with the proposed Energy Center. This section is therefore not applicable to the project.

## 2.17 DUST CONTROL MEASURES

During the construction phase, emission sources include site preparation activities, fugitive dust resulting from mobile equipment, and wind-blown fugitive particles. Temporary air emissions during the construction phase of the Energy Center result primarily from fuel combustion emissions from trucks and construction equipment.

Total suspended particulates constitute the majority of the air emissions during the construction phase; most of which are fugitive dust emissions from grading activities and from excavation, hauling, loading, and dumping. Minor emissions of Sulfur Dioxide ($SO_2$), Nitrogen Oxides ($NO_x$), and Carbon Monoxide (CO) will result from mobile equipment exhausts.

Potential dust resulting from construction activities and truck traffic will be controlled following standard construction practices, which may include watering of exposed surfaces, covering disturbed areas, reduced speed limits on the site or other such practices as needed. It is anticipated that emissions during the construction phase will be generally limited to the Project Area and will not be dissimilar to the construction of numerous other businesses (i.e., office building and commercial property). Following construction, fugitive dust related to vehicular traffic at the Energy Center will be minimal because all access roads will be graveled .

## 2.18 SURFACE WATER RESOURCES

Wisconsin Wetland Inventory (WWI) Maps were reviewed to identify the potential of wetland and waterbody impacts by the project. Wetlands in the Project Area are sporadic (see Figure 19 A-B). Based on the WWI map, there are approximately 495 acres of wetlands in the Project Area. Forward Energy will make efforts to locate the wind turbines, access roads and collection system to avoid or minimize impact to wetlands and waterbodies.

Wisconsin is divided into 3 major river basins each identified by the primary waterbody into which the basin drains. The 3 river basins include the Lake Superior Basin, Mississippi River Basin and the Lake Michigan Basin. To support their Water Quality Management Plans (WQMP), WDNR developed 24 Water Management Units (WMU) based on hydrologically connected subdivisions of the larger major basins of the state. The WQMP's are now being replaced by the State of the Basin Reports.

The Project Area is located within the Upper Fox and Upper Rock WMU and includes the following tributaries:

**Table 9**
**Tributaries Within the Project Area**

| TRIBUTARY | WATER MANAGEMENT UNIT |
|---|---|
| **Lake Michigan Basin** | |
| Campground Creek | Upper Fox |
| **Mississippi River Basin** | |
| Fink Creek | Upper Rock |
| Gill Creek | Upper Rock |
| Horicon Marsh | Upper Rock |
| Irish Creek | Upper Rock |
| Kummel Creek | Upper Rock |

The proposed 303(d) Impaired Waters List for 2004 was reviewed for each of the tributaries listed above. Gill Creek, Horicon Marsh, Irish Creek and Kummel Creek are each listed as having sedimentation problems and as having a degraded habitat.

Campground Creek is considered a Class II trout stream from Fond Du Lac County Highway Y to a point near its headwaters, approximately 3 miles upstream. The main water quality problem in Campground Creek is from nonpoint sources of pollution, particularly bank erosion due to cattle grazing. Sedimentation from farm tillage practices is also a problem in the downstream reach. Runoff due to excessive stray irrigation by a canning company near Oakfield has occasionally reached the stream and has also caused water quality problems. There are also some unnamed tributaries to the creek that have intensive agricultural operations on land adjacent to them. Some of these operations may be affecting water quality in Campground Creek.

According to the Upper Rock River WMP, the use impairment of Fink Creek is unknown.

Gill Creek and Irish Creek are part of a Natural Resource Conservation Service (NRCS) Environmental Quality Incentives Project. The DNR and Dodge County Land Conservation Department (LCD) are working with the NRCS and area farmers to install practices as needed, including streambank buffers, conservation tillage, and nutrient pesticide plans. Both creeks have been monitored by the DNR for water quality concerns where high levels of nitrate were observed.

Irish Creek at one time was the best trout stream in Dodge County; however, pond construction on the headwater springs coupled with streambank grazing and bank erosion have affected water quality and instream habitat. The stream has the potential to be a Class II trout stream.

Horicon Marsh has been designated as a "Wetland of International Importance." The most severe problem facing the Marsh is siltation due to soil erosion from the surrounding watersheds. The largest source of sediment is soil erosion from agricultural lands. Other issues facing the Marsh include fish infestation (mainly carp), purple loosestrife infestation, high inflow of nutrients from surrounding farms, pastures, and barnyards, and the loss of wildlife habitat.

Sediment and silt deposition is severe in pool areas of Kummel Creek. Portions of the creek have been channelized. In 2000, the DNR conducted baseline monitoring of the stream. Initial evaluation shows the creek to be in fair to poor condition.

The Energy Center will not directly impact any of these tributaries. Forward Energy will avoid impacts to wetlands and waterbodies by boring under such areas when installing the collection system. Forward Energy will prepare a Stormwater Pollution Prevention Plan (SWPPP) for the Energy Center. This plan will be developed to reduce the discharge of pollutants in stormwater runoff to prevent further degradation of these tributaries.

## 2.19 WATER USE AND SOURCE – WELL OR MUNICIPAL WATER

The Energy Center will not require water for operation of the facility. Municipal water will be used during construction for dust suppression and other typical construction uses.

Potable water will be required for offices located in the O&M building. The location of the O&M building has not been determined at this time. Forward Energy is looking into options of purchasing or leasing an existing building in the Project Area. If in the unlikely event a suitable existing location cannot be found a new structure will be constructed. It is anticipated that potable water will be obtained from the local municipality.

## 2.20 WATER USE AND SOURCE – SURFACE WATERBODY

The proposed Energy Center will not utilize any water from a surface waterbody during construction or operation activities. This section is therefore not applicable to the project.

## 2.21 WASTER USAGE AND DISCHARGE – SURFACE WATERBODY OR MUNICIPAL

There are no process water requirements or wastewater discharges from the operation or maintenance of the Energy Center. This section is therefore not applicable to the project.

## 2.22 INTAKE AND OUTFALL STRUCTURES

There are no process water requirements or wastewater discharges from the operation or maintenance of the Energy Center. This section is therefore not applicable to the project.

## 2.23 WASTEWATER AND STORMWATER TREATMENT

There are no wastewater or stormwater treatment facilities associated with the Forward Energy Center Project. This section is therefore not applicable to the project.

## 2.24 STORMWATER MANGEMENT

Forward Energy will prepare a Stormwater Pollution Prevention Plan (SWPPP) for the Energy Center. This plan will describe the Energy Center and its operations, identify potential sources of stormwater pollution at the Energy Center, and recommend appropriate Best Management Practices (BMPs) or pollution control measures to reduce the discharge of pollutants in stormwater runoff. The Wisconsin Construction Site Best Management Practice Handbook will be utilized during the development of this plan along with regional stormwater management planning guidelines.

Fond Du Lac County requires an erosion and runoff control permit under section 27-6 of the County Code. This permit requires the development of a stormwater management plan, erosion control plan and financial guarantee.

Dodge County requires the development of a soil erosion control plan under Section 7.9.3 of their Land Use Code. Dodge County also requires that a stormwater management plan be prepared in accordance with the guidelines of Section 7.9.6. According to this code, the natural drainage patterns and pre-development annual runoff volumes and peak flows of the site should be maintained as nearly as practicable.

Forward Energy will provide a copy of the SWPPP to the Fond Du Lac County and Dodge County Land Use Administrators for review and approval. Forward Energy will also develop a soil erosion control plan and provide a copy to appropriate agencies.

## 2.25 SOLID WASTE

The Facility will not generate solid waste during the electricity production process. All office waste will be transported and disposed of by a licensed waste hauler.

## 2.26 FARM OPERATIONS

Forward Energy will identify and minimize any potential impacts to drain tiles. Often, drainage tile cannot be accurately located. However, landowners or tenants will be consulted to try to determine the location and depth of existing tile systems. If tile locations are known prior to construction activities, the drain tile will be flagged and measures will be taken, to the extent practicable, to minimize interference.

Landowners will be compensated for the loss of crop during construction activities and will be provided compensation for permanent crop loss based on the land occupied by the Energy Center. Land adjacent to the wind turbine base and associated access road will be allowed to remain agricultural. An attraction of wind energy is that the turbines do not interfere with the use of the land for farming or cattle grazing.

The placement of the wind turbines will allow for the continued agricultural use of the land by the farming community. In addition, the payments to landowners resulting from the location of the wind turbines strung across a farm at appropriate intervals will provide a welcome boost to farm income, yielding a year-round cash flow. This additional income will not be subjected to times of low crop prices or low crop yields.

## 2.27 NOISE ORDINANCES

The State of Wisconsin legislative website and Fond Du Lac County website was searched for information pertaining to noise ordinances. The State of Wisconsin and Fond Du Lac County have not established limits on industrial noise emissions.

Dodge County Land Use Code Section 8.5.3 establishes regulations that no activity or operation shall exceed the maximum permitted sound levels set forth below at the property line of the

receiving premises. Table 8 identifies the maximum sound pressures allowed under this ordinance.

**Table 10**
**Maximum Allowable Sound Pressure Levels**

| Source of Sound and Time | Premises Receiving Sound/Sound Level Decibel - db(A) | | |
|---|---|---|---|
| | **Residential** | **Commercial/Industrial** | **Industrial** |
| Residential (Day) | 55 | 60 | 60 |
| Residential (Night) | 50 | 50 | 50 |
| Commercial/Industrial (Day) | 55 | 60 | 65 |
| Commercial/Industrial (Night) | 50 | 50 | 55 |
| Industrial (Day) | 55 | 60 | 70 |
| Industrial (Night) | 50 | 50 | 60 |
| Note: Night is defined as the hours between 10:00 p.m. and 7:00 a.m. | | | |

In the event that noise resulting from the Energy Center exceeds the maximum limits allowed, a waiver may be granted according to Dodge County Land Use Code Section 4.11.3 (D). A copy of the Dodge County Noise Ordinance is provided in Appendix D.

## 2.28 PROJECTED NOISE MEASUREMENTS

A sound study was conducted for the proposed Energy Center in accordance with the February 2002 "*Measurement Protocol for Sound and Vibration Assessment of Proposed and Existing Electric Power Plants"* (Measurement Protocol) issued by the PSC.

Based on the results of this study, predicted sound levels at nearby receivers will range in decibels (dB) from the low 50's to lower than audibly perceptible. The highest turbine sound levels would generally be observed during high wind speeds. Coincidentally, this same high wind speed raises background ambient sound levels and provides acoustical masking of wind turbine noise. The majority of receivers/structures will experience levels less than 45 dBA and 65 dBC, which are sufficiently low so as to minimize or eliminate any potential for sleep interference, indoor/outdoor speech interference, and annoyance due to low-frequency noise. These levels are consistent with guidelines established by the USEPA for acceptable levels of noise within residential land uses.

Within three months after the project is fully operational, sound and vibration measurements will be repeated. To the extent feasible, post-construction sound level measurements will be taken both with units operating at full capacity and with units off. Post construction measurements will be reported to the PSC using the same format previously approved for the sound and vibration studies.

A copy of the sound study is provided in Appendix G.

## 2.29 NOISE IMPACTS FROM COAL-SPECIFIC SOURCES

The Energy Center will not require coal for operation. This section is therefore not applicable to the project.

## 2.30 SITE LIGHTING

Both the FAA and WisDOT will be consulted to determine the appropriate lighting for the Energy Center. Considerations will be made to reducing the potential impact to migratory birds and bats and to develop a pattern that will produce adequate lighting for aviation safety while minimizing aesthetic impacts. Based upon the avian study, Forward Energy will recommend the use of L864 flashing red lights with the shortest possible flash time and longest possible duration between flashes. The FAA and WisDOT will ultimately determine the needed lighting to maintain aviation safety and which turbines and what type of lighting is required.

No lighting is anticipated during construction and operation of the Energy Center other than lighting required by the FAA. The Energy Center will not require security measures or fencing.

## 2.31 EXPECTED ODORS

No objectionable odors are expected as a result of construction or operation of the proposed Energy Center.

## 2.32 ROAD ICING OR FOGGING

No emissions are associated with the proposed Energy Center. This section therefore is not applicable to the project.

## 2.33 ENVIRONMENTAL MITIGATION

After the completion of construction all disturbed areas will be finish graded and any remaining trash or debris will be properly disposed of. The construction areas of the site will be protected by the implementation of appropriate erosion control measures, including site-specific contouring, reseeding, or other measures agreed to by landowners. Areas surrounding each wind turbine used during construction will revert to the original land use after construction. The erosion control measures used will be in accordance with any applicable state and local soil and erosion control plan guidelines.

Cleanup and restoration procedures will be initiated as soon as possible after construction activities. Final cleanup will typically involve a series of steps, including off-site waste material disposal and equipment removal. Restoration operations will involve surface grading and the reestablishment of natural contours and vegetation.

The existing landscape in the Project Area consists mainly of agricultural fields with small tree lines and forested tracks. After construction of the proposed Energy Center, aesthetically the landscape will remain much the same with the exception of several wind turbines that will dot the landscape in a non-uniform fashion. While the wind turbines will be noticed on the landscape, the project will allow for the continued agricultural use of the land by the farming community. In addition, the landowners participating in the project will see a sustained financial benefit while the turbines are operating providing them additional income to support their current agricultural and farming practices.

## 2.34 COMMUNITY RESOURCE MAPS

Figure 22 (A-B) provides a map identifying roads, streets, and city and town boundaries for the Project Area and also identifies all publicly owned lands within ½-mile of the Project.

Residences and other buildings near the Project Area and within 1/2-mile of the Project Area are identified on aerial photography included as Figure 21 (A-D). This figure also identifies a 1,000 foot buffer around each structure. There will be no turbines located within 1,000 feet of occupied structures, unless agreed to by the property owner. The turbines will also be sited a minimum of 1.1 times their height from any public roads or aboveground electric utility lines.

## 2.35 SENSITIVE COMMUNITY AREAS

Figure 22 (A-B) identifies community resources and potentially sensitive community areas. This figure identifies schools, cemeteries, churches, and municipal buildings within the Project Area. This figure was developed based on 2000 Census Tiger Line Data and ESRI Data and Maps.

## 2.36 PUBLICLY OWNED LANDS

A study of the proximity of publicly owned lands (parks, county forests, schools, etc.) within ½-mile of the proposed Project Area was conducted to determine if these institutions might be impacted by the proposed Energy Center. The study primarily consisted of a review of Plat Maps, U.S. Census Bureau Tiger Line Data, other available maps and Internet search. Appendix H provides a list of the publicly owned lands within the Project Area. The following summarizes two public recreational areas identified during the review.

*Horicon National Wildlife Refuge*

The Horicon National Wildlife Refuge is located west and southwest of the Project Area. The National Wildlife Refuge is approximately 21,000 acres in size and makes up the northern two-thirds of the marsh. This portion of the marsh is managed by the USFWS. The southern one-third is administered by the WDNR and is known as the Horicon Marsh State Wildlife Area. The State Wildlife Area is approximately 11,000 acres in size. The marsh as a whole is the largest freshwater cattail marsh in the United States. In 1846 settlers constructed a dam on the Rock River that changed the Horicon marsh into the largest artificial lake in the world at the time (Horicon Lake). The dam was later removed in 1869, which resulted in the conversion of the land back to marsh. Congress established the Horicon National Wildlife Refuge in July 1941 for the protection and conservation of migratory birds.

*Wild Goose State Trail*

The Wild Goose State Recreation Trail is located northwest of the Project Area along an old railroad right-of-way. The trail is maintained and operated by Fond Du Lac and Dodge Counties and is owned by the WDNR. The trail is used for bicycle riding, hiking and as a snowmobile trail.

The Horicon National Wildlife Refuge and Wild Goose State Trail will not be directly affected by the construction or operation of the Energy Center.

## 2.37 DEMOGRAPHICS

Demographic information used for this analysis was obtained from the 2000 U.S. Census. Demographics of the tracts around the Project Area were examined and compared with the demographics of Fond Du Lac and Dodge Counties, Wisconsin. Census tract 419 encompasses the Project Area in Fond Du Lac County and census tract 9601 and 9602 encompasses the Project Area in Dodge County.

Table 11 summarizes the demographic characteristics.

**Table 11**
**Demographic Information – U.S. Census 2000**

| CRITERIA | U.S. | WISCONSIN | FOND DU LAC COUNTY | DODGE COUNTY | CENSUS TRACT 419 | CENSUS TRACT 9601 | CENSUS TRACT 9602 |
|---|---|---|---|---|---|---|---|
| **General Demographics** | | | | | | | |
| Total Population | 281,421,906 | 5,363,675 | 97,296 | 85,897 | 6,797 | 5,955 | 3,297 |
| % - White | 75.1 | 88.9 | 96.2 | 95.3 | 98.5 | 98.2 | 98.5 |
| % - African American | 12.3 | 5.7 | 0.9 | 2.5 | 0.1 | 0.2 | 0.1 |
| % - All Other | 12.6 | 5.4 | 2.9 | 2.2 | 1.4 | 1.6 | 1.4 |
| **Economic Characteristics** | | | | | | | |
| % - Employed | 59.7 | 65.8 | 67.6 | 64.3 | 73.4 | 72.4 | 71.6 |
| % - Unemployed | 3.7 | 3.2 | 3.0 | 2.2 | 2.7 | 2.0 | 1.4 |
| Median Household Income | $41,994 | $43,791 | $45,578 | $45,190 | $50,149 | $49,632 | $52,246 |
| % - Families Below Poverty Level | 9.2 | 5.6 | 3.5 | 3.7 | 2.8 | 2.6 | 3.4 |
| **Housing Characteristics** | | | | | | | |
| Median Value of Owner Occupied Units | $119,600 | $112,200 | $101,000 | $105,800 | $124,300 | $117,700 | $110,700 |

The demographic characteristics of the area surrounding the proposed Energy Center were evaluated to determine the potential for environmental justice claims based on a disproportionate number of minorities or low-income population near the proposed Project Area. The Project Area is located in southeast Wisconsin within the northern portion of Dodge County and southern portion of Fond Du Lac County.

As indicated in Table 11, the demographics of the census tracts surrounding the proposed Project Area consist of minority populations that are less than those found at the county, state or national

levels. Furthermore, the percentage of population that earns above the poverty level is significantly higher in these census tracks than the state or national level.

Based on this data, no significant numbers of minorities or low-income people are represented in the vicinity of the proposed Energy Center.

## 2.38 COMMUNITY SERVICES

Railroad and/or roadways will be used to facilitate the delivery of equipment necessary for the construction of the Energy Center. Police services may be required to assist in temporary traffic diversion during the delivery of large equipment to the site.

Emergency assistance may be necessary in the event of an accident. The type of service that may be requested during construction and operation will be emergency services the Town or County currently provides to the surrounding area. Safety precautions and procedures will be in place in an attempt to prevent any such incident.

## 2.39 LOCAL GOVERNMENT INFRASTRUCTURE

Forward Energy does not anticipate the requirement of improvements to the local government infrastructure to facilitate the project. Police and fire protection will be provided by the local municipalities. It is not anticipated that the Energy Center will burden these existing services.

Any necessary permits or approvals required to transport equipment or materials to the Energy Center will be obtained by the licensed hauler. If required, a bond may also be posted by the hauler to assure that any road damage will be fixed.

## 2.40 EFFECT ON COMMUNITY BUDGET

There are no anticipated improvements or increased requirements to the local infrastructure that would be required for the Energy Center. Therefore it is not expected that the Energy Center will create a burden on the community budgets.

## 2.41 TAX REVENUE

The Towns of Byron, LeRoy, Lomira, and Oakfield, and the Counties of Dodge and Fond du Lac will receive payments from the state public utility fund as a result of the construction and operation of the Forward Energy Center. While the precise amounts of the payments will be

determined by the state of Wisconsin, the following description provides general information regarding these payments.

The revenue generated by the sale of electricity from the Forward Energy Center is subject to a Wisconsin Gross Receipts tax which is paid into the state's general fund. The towns and counties in which the Forward Energy Center operates and has turbines located will receive a direct benefit from these payments in the form of state revenue sharing payments. These payments made from the state revenue sharing program will be made on an annual basis and will consist of two types.

The first type of payment is based on the size of the production plant's capacity and is shared between a town and a county in which the production plant is operating and has turbines located. The total payment is equal to $2,000 times the megawatt capacity of the production plant. Based on the state of Wisconsin calculations this payment is shared between the town and county.

The second type of payment is available because the Forward Energy Center will generate energy from a renewable resource. Under the second type of payment, a town and a county each would receive a payment equal to $1,000 times the megawatt capacity of the production plant located in a town and in a county.

Under the first type of payment, the amount paid to a town is limited to the town population multiplied times $300 and the amount paid to a county is limited to the county population times $100.

Subject to the calculation to be made by the state of Wisconsin, Forward Energy has estimated the applicable towns and counties will receive approximately $800,000 of combined payments on an annual basis as a direct result of the construction and operation of the Forward Energy Center.

## 2.42 BENEFITS TO COMMUNITY

Local municipal and county governments will receive additional revenue through the state shared revenue program as a result of the generating capacity being located in their jurisdictions.
Efforts will be made to hire individuals from the local communities for the construction and operation of the Energy Center. When possible, construction materials will be purchased from the local area. In addition, it is anticipated that lodging, restaurants and other service related industries and consumables will be purchased by the construction workforce.

The placement of the wind turbines will allow for the continued agricultural use of the land by the farming community. In addition, the payments to landowners resulting from the location of the wind turbines will provide a boost to farm income, yielding a year-round cash flow. This additional income will not be subjected to times of low crop prices or low crop yields.

## 2.43 RETIREMENT OF EXISTING FACILITIES

Retirement of existing facilities is not proposed as part of this project. This section is therefore not applicable to the project.

## 2.44 CONSTRUCTION TRAFFIC

There are two types of vehicle trips associated with construction activity: worker trips and equipment/supply delivery trips. The first type, worker trips, involves a construction employee traveling to and from the job site. The primary impact on traffic will be from these worker trips or construction employee vehicles. Due to the project location, the construction workers will likely be coming from a variety of surrounding areas including Fond Du Lac (from the north), Waupun (from the west), Beaver Dam (from the southwest), Mayville (from the south) and West Bend (from the southeast). Depending upon the available labor pool, construction workers may travel from major metropolitan areas such as Sheboygan (from the northeast), Milwaukee (from the Southeast) or Madison (from the southwest). Commuters may also come from other smaller communities near the Project Area such as Lomira, Brownsville and Oakfield.

Due to the wide area of the potential labor pool, the construction workers will reach the Project Area by a variety of routes, easing traffic on any one specific road. Roads which the commuters may utilize include U.S Highway 41 or State Highway 175 which runs north-south on the eastern portion of the Project Area, State Highway 49 which runs east-west through the northern portion of the Project Area, State Highway 28 and 67 from the south and southwest, or the numerous County and Town Roads which transect the Project Area.

The average number of construction workers at the Project Area is expected to be around 150 workers, which translates up to approximately 300 worker trips (arriving and departing the Project Area). However, as many as 250 workers may be present during peak periods of construction. Therefore, a maximum of 500 worker trips may occur on a daily basis.

The second type of traffic associated with construction activities involves trips by trucks delivering construction material, equipment, and supplies. Most construction materials, bulk

materials, and equipment for the Energy Center will be delivered by truck or rail. Heavy construction equipment, including mobile cranes, earth moving equipment and dump trucks, will also be delivered to the Project Area in this manner. Traffic loads from construction vehicles will make multiple trips to the Project Area on a daily basis, especially those that provide certain construction materials such as concrete.

Levels of truck traffic will vary depending on the phase of construction. Truck deliveries will typically be distributed evenly over a ten hour delivery day. Delivery of heavier and/or oversize loads will be coordinated with local officials. The impacts on current traffic conditions during construction will be temporary. Construction traffic will utilize roadways with sufficient capacity to handle the expected number of vehicles, but congestion from vehicles entering and exiting the Project Area may affect traffic flow. Due to the central proximity of the Project Area, it is likely that these trucks will reach the Project Area the same way as the construction traffic. This provides the same benefit of minimizing the overuse on any single road.

Forward Energy will work with the local communities to coordinate traffic flow and will limit construction traffic to normal working hours except in the event of emergencies.

## 2.45 IMPACTS OF CONSTRUCTION TRAFFIC

As discussed in Section 2.44, the Project Area is centrally located within the potential labor pool, and shipment of construction materials and equipment would be received from many sources throughout the regional area. Because laborers and construction materials and equipment will come from various locations to the site, impacts from construction traffic on the local roads is expected to be minimum.

## 2.46 TRAFFIC DURING OPERATION

It is anticipated that the Energy Center will employ approximately 6 to 10 permanent employees (1 shift/5 days a week), based on trends of current facilities of similar capacity. Only a small number of vehicles will be required to deliver supplies and equipment during operation.

## 2.47 PERMANENT IMPACTS TO TRANSPORTATION INFRASTRUCTURE

The only anticipated permanent changes to the surrounding roadways are the addition of an access road to each wind turbine site.

# 3.00 ELECTRIC TRANSMISSION SYSTEM

## 3.01 TRANSMISSION INTERCONNECTION STUDY

Each wind turbine generates an output at 690 volts (V) that is converted to 34.5 kilovolts (kV) by a transformer located at each wind turbine. The 34.5 kV side of the transformer is connected to an underground collection system that connects the output in circuits of approximately 20 to 25 Megavolt Ampere (MVA). The Energy Center will have a single collection bus at a voltage of 34.5 kV. A 34.5 kV cable and a 138/34.5 kV transformer will connect the collection bus to a new 138 kV straight-bus substation that will interconnect the Energy Center to the existing American Transmission Company, LLC (ATC) South Fond Du Lac-Butternut 138 kV line.

An Interconnection Evaluation Study Report was prepared by ATC to evaluate the potential impact of the addition of up to 200 MW of wind generation to the existing electrical transmission system in the Project Area. The study identified the project would be able to connect via a radial 138 kV transmission line to the Butternut Substation or by connecting at a voltage of 138 kV on line 33542 between the South Fond Du Lac and Butternut substations. A Facility Study analysis is currently being conducted to further evaluate the interconnection and identify potential issues identified during the interconnection study.

A copy of the Interconnection Evaluation Study Report is included in Appendix I.

# 4.00 OTHER

## 4.01 ALPHABETIZED LISTS

An alphabetized list of property owners within the Project Area and ½-mile buffer, including publicly owned land, is provided in Appendix J. This appendix also includes contact information for local municipalities and libraries within the Project Area and ½-mile buffer.

## 4.02 PUBLIC OUTREACH

Forward Energy has met with Project Area landowners to discuss landowner interest in entering into an agreement with Forward Energy regarding wind turbine(s) and related facilities associated with their proposal to develop an Energy Center in Fond Du Lac and Dodge Counties, Wisconsin. Forward Energy has also met with local officials to present the proposed Energy Center and discuss the opportunities associated with the project to their constituency. Forward Energy hosted two informational meetings (March 2 and April 8, 2004) for landowners and local

officials. These meetings were held to allow the landowners and local officials to learn more about the proposed Energy Center and provided an opportunity for the attendees to ask questions they might have about the project. Forward Energy will continue to meet with local officials and landowners and will conduct informational meetings throughout the development of the Energy Center.

## 4.03 FUTURE PLANS

Forward Energy will continue to meet and coordinate with landowners and community officials during the course of the project. The majority of coordination will be done on a one-on-one basis. As the project progresses a combination of public meetings, mailings and public announcements will be utilized to communicate information about the project.

## 4.04 LOCAL MEDIA

The following sources were identified as the most effective resources for the communication of the project for both a written and broadcast announcement:

**TABLE 12**
**LOCAL MEDIA CONTACT INFORMATION**

| LOCAL MEDIA | CONTACT INFORMATION | ANNOUNCEMENT TYPE |
|---|---|---|
| Radio 107.1 KFIZ | Bob Nelson<br>News Team Member<br>254 Winnebago Drive<br>P.O. Box 1450<br>Fond Du Lac, WI 54936-1450<br>Ph: (920) 921-1071, ext. 249<br>Fax: (920) 921-0757<br>Cell: (920) 960-1809<br>E-Mail: BNELSON@KFIZ.COM | Broadcast |
| Fond Du Lac Reporter | Mike Mentzer, Editor<br>33 W. 2nd Street<br>P.O. Box 630<br>Fond Du Lac, WI 54936-0630<br>Ph: (920) 922-4606 extension 247<br>Fax: (920) 922-3552<br>E-Mail: thereporter@thomnews.cfom | Written |
| Horicon Reporter | Robert Rettman, Editor<br>411 E. Lake Street<br>P.O. Box 164 | Written |

| LOCAL MEDIA | CONTACT INFORMATION | ANNOUNCEMENT TYPE |
|---|---|---|
| | Horicon, WI 53032<br>Ph: (920) 485-2016<br>Fax: (920) 485-2820 | |
| Mayville News | Sue Kahlhamer, Editor<br>P.O. Box 271<br>Mayville, WI 53050<br>Ph: (920) 387-2211<br>Fax (920) 387-5515<br>E-Mail: editor@mayvillenews.com | Written |
| Milwaukee Journal Sentinel | Marty Kaiser, Editor<br>333 W. State Street<br>P.O. Box 661<br>Milwaukee, WI 53201-0661<br>Ph: (414) 224-2345<br>Fax: (414) 224-2047<br>E-Mail: mkaiser@onwis.com | Written |
| Neighbors | Diana Mueller, Editor<br>1118 ½ Main Street<br>P.O. Box 111<br>Waupun, WI 53963<br>Ph: (920) 326-5151<br>Fax: (920) 324-8582<br>E-Mail: waupunedit@conleynet.com | Written |
| The Business Journal | Pete Millard, Energy Reporter<br>600 W. Virginia Street, Suite 500<br>Milwaukee, WI 53204<br>Ph: (414) 278-7788<br>Fax: (414) 278-7028<br>E-Mail: pmillard@bizjournals.com | Written |
| The Capital Times | Mike Ivey, Business Reporter<br>1901 Fish Hatchery Road<br>P.O. Box 8060<br>Madison, WI 53708<br>Ph: (608) 252-6431<br>Fax: (920) 252-6445<br>E-Mail: mivey@madison.com | Written |
| Wisconsin State Journal | Jennifer Sereno, Business Editor<br>1901 Fish Hatchery Road<br>P.O. Box 8058<br>Madison, WI 53708<br>Ph: (608) 252-6155<br>Fax: (608) 252-6119<br>E-Mail: jsereno@madison.com | Written |

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